

ENVIRONMENTAL SITE ASSESSMENT AND GROUND WATER MONITORING

Federal Center South
4735 East Marginal Way South
Seattle, Washington

Prepared for

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Contents

Executive Summary	1
Site Background.....	3
Site Location and Description	3
Geology and Hydrogeology.....	7
Tank Removal	9
Initial Site Investigation Summary	11
Drilling and Sampling Procedures.....	11
Soil Sample Collection from Push Probe Borings	13
Ground Water Sample Collection from Push Probe Borings.....	13
Sample Analyses.....	13
Data Quality Assurance Review	14
Results of Initial Site Investigation.....	15
Subsurface Conditions	15
Soil Analytical Results	15
Ground Water Analytical Results	17
Additional Soil Excavation.....	19
Dispenser Area Excavation.....	19
Waste Oil Tank Area Excavation	19
Excavation Backfill Activities.....	20
Monitoring Program Summary	23
Sample Locations and Methods.....	23
Drilling and Well Installation.....	23
Sample Analyses.....	25
Data Quality Assurance Review	25
Results.....	27
Subsurface Soil Conditions	27
Site Ground Water Conditions—July 6, 1999	27
Ground Water Analytical Results—July 6, 1999.....	28
Conclusions.....	31
References.....	33

Appendix A	Field Procedures
Appendix B	Boring Logs and Well Construction Details
Appendix C	Initial Site Investigation, Laboratory Analytical Certificates—OnSite Environmental Inc.
Appendix D	Photographic Documentation
Appendix E	Weigh Tickets—Remedco, Inc.
Appendix F	Ground Water Monitoring Program , Laboratory Analytical Certificates—OnSite Environmental Inc.

Tables

Table 1. Petroleum hydrocarbon results of soil samples collected from probe borings drilled at Federal Center South, Seattle, Washington (mg/kg).	16
Table 2. Metal results of samples collected from probe borings at Federal Center South, Seattle, Washington (mg/kg).....	17
Table 3. Petroleum hydrocarbon results of ground water samples collected from probe borings at Federal Center South, Seattle, Washington (µg/L).	17
Table 4. Ground water surface elevation data collected on July 6, 1999 from monitoring wells at Federal Center South site, Seattle, Washington.....	28
Table 5. Petroleum hydrocarbons and BTEX results of ground water samples collected on July 6, 1999 from monitoring wells at the Federal Center South site (µg/L).	30

Figures

Figure 1. Location map, Federal Center South, Seattle, Washington.	4
Figure 2. Site location map, Federal Center South, Seattle, Washington.....	5
Figure 3. Former waste oil tank T7 and gasoline tank T8 location map, Building 12.03 at Federal Center South, Seattle, Washington.....	6
Figure 4. Analytical results from push probe borings at Federal Center South, Seattle, Washington.	12
Figure 5. Areas of additional excavation adjacent to Building 12.03 at Federal Center South, Seattle, Washington.	21
Figure 6. Water level contour map, July 6, 1999, Federal Center South, Seattle, Washington.	24
Figure 7. Petroleum hydrocarbon results of ground water samples collected on July 6, 1999 from wells at Federal Center South, Seattle, Washington.	29

Work for these investigations were performed in accordance with applicable planning documents and generally accepted professional standards and practices for the type of work performed. While information regarding subsurface conditions, including soil and ground water quality, is believed to be generally representative of conditions at the site, conditions may change within short distances. Additional subsurface materials and contaminants may be present at locations not investigated during this study.

Executive Summary

This report presents results and documents site conditions discovered during site assessments associated with underground tank removal at the Federal Center South facility located in Seattle, Washington. Following tank and contaminated soil removal, an initial site investigation, additional removal of contaminated soil, and a follow-up site investigation were conducted at the site. Limited exploration during the tank removal process indicated a gasoline release beneath a former fuel dispenser unit, extending approximately 30 feet to the south and west. Approximately 100 feet south of the gasoline tank, a waste oil tank also was found to have released diesel and heavy oil to soil immediately surrounding the tank.

The Federal Center South facility is located at 4735 East Marginal Way South (Figure 1), along the eastern riverbank of the Duwamish Waterway within the industrial portion of South Seattle. The removed tanks included a 12,000-gallon gasoline tank used to provide fuel for motor pool vehicles and a 1,000-gallon waste oil tank used for storage of fluids resulting from motor pool vehicle maintenance. Both tanks were registered with the Washington Department of Ecology (Ecology).

The initial investigation included subsurface soil and ground water sampling at 15 locations surrounding the 12,000-gallon gasoline tank and 1,000-gallon waste oil tank to the south. Sampling indicated gasoline free product approximately 15 feet south of the previous tank excavation, with evidence of contaminated soil extending another 20 feet. Contamination at the waste oil tank appeared to be limited adjacent to the tank. Further excavation of contaminated soil was completed above the water table in both areas and seven monitoring wells were installed to determine extent of contaminant migration and ground water flow characteristics. Ground water monitoring was initiated, with flow direction determined to be west-southwest and contamination found to be limited to near the tanks. Ground water monitoring will continue on a quarterly basis to determine the effectiveness of source removal and contaminant migration characteristics.

Site Background

Site Location and Description

The Federal Center South facility is located at 4735 East Marginal Way South in Seattle, Washington (Figure 1). The subject site is located in King County, in the NW $\frac{1}{4}$ of the NE $\frac{1}{4}$ of section 19, township 24 north, range 4 east from the Willamette Meridian (USGS 1983). The site is bounded by commercial and industrial properties to the north, the Duwamish Waterway to the west, and office and warehouse buildings housing several federal agencies to the south and east.

The site is approximately 5 to 10 feet above mean sea level, consisting of a relatively level concrete/asphalt parking lot and several multi-story office and warehouse buildings. No soil is exposed to the surface at any place in the site vicinity. The layout of the former tanks and surrounding site features pertinent to this project are shown in Figures 2 and 3. The waste oil tank was located immediately adjacent to the west side of building 12.03, and the gasoline tank was located approximately 20 feet west of the same building. The former waste oil tank was used for disposal of fluids during motor pool vehicle maintenance, and the gasoline tank was used to provide fuel for motor pool vehicles. The dispenser was removed from the south end of the tank when service ended in the late 1980s.

Both tanks were registered with the Washington state Department of Ecology (Ecology) associated with site identification number 10042. According to U.S. General Services Administration information, tank T7 was used until the early 1990s, and tank T8 was removed from service in the late 1980s. No other potential sources for hazardous substances were identified at the site.

The contamination investigation was initiated as a result of encountering petroleum hydrocarbon contamination in soil surrounding the gasoline and waste oil tanks during tank removal and decommissioning activities conducted in May 1998. An initial investigation was conducted at the time of tank removal by digging test pits to the south and west of the gasoline tank (Herrera 1999). A follow-up investigation was conducted in August 1998 following tank closure, which included soil and ground water sampling at 15 boring locations across the site using the push probe drilling method. Based on the results of these field efforts, additional excavation and removal of petroleum-contaminated soil at the south end of the gasoline tank and immediately west of the waste oil tank was conducted in April 1999. In June 1999, seven monitoring wells were installed and ground water samples collected as part of the beginning of a ground water monitoring program implemented at the site.



Figure 1. Location map, Federal Center South, Seattle, Washington.

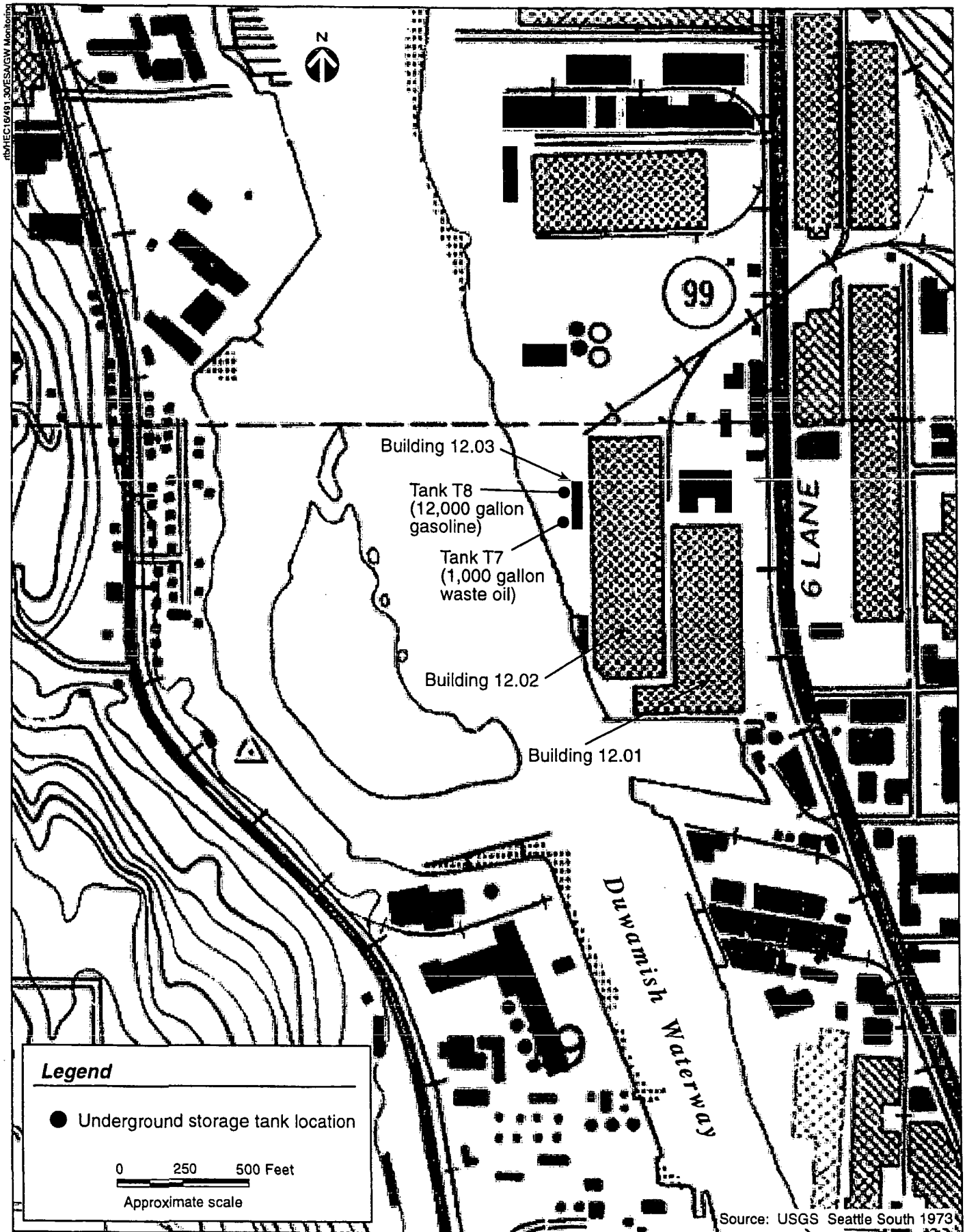
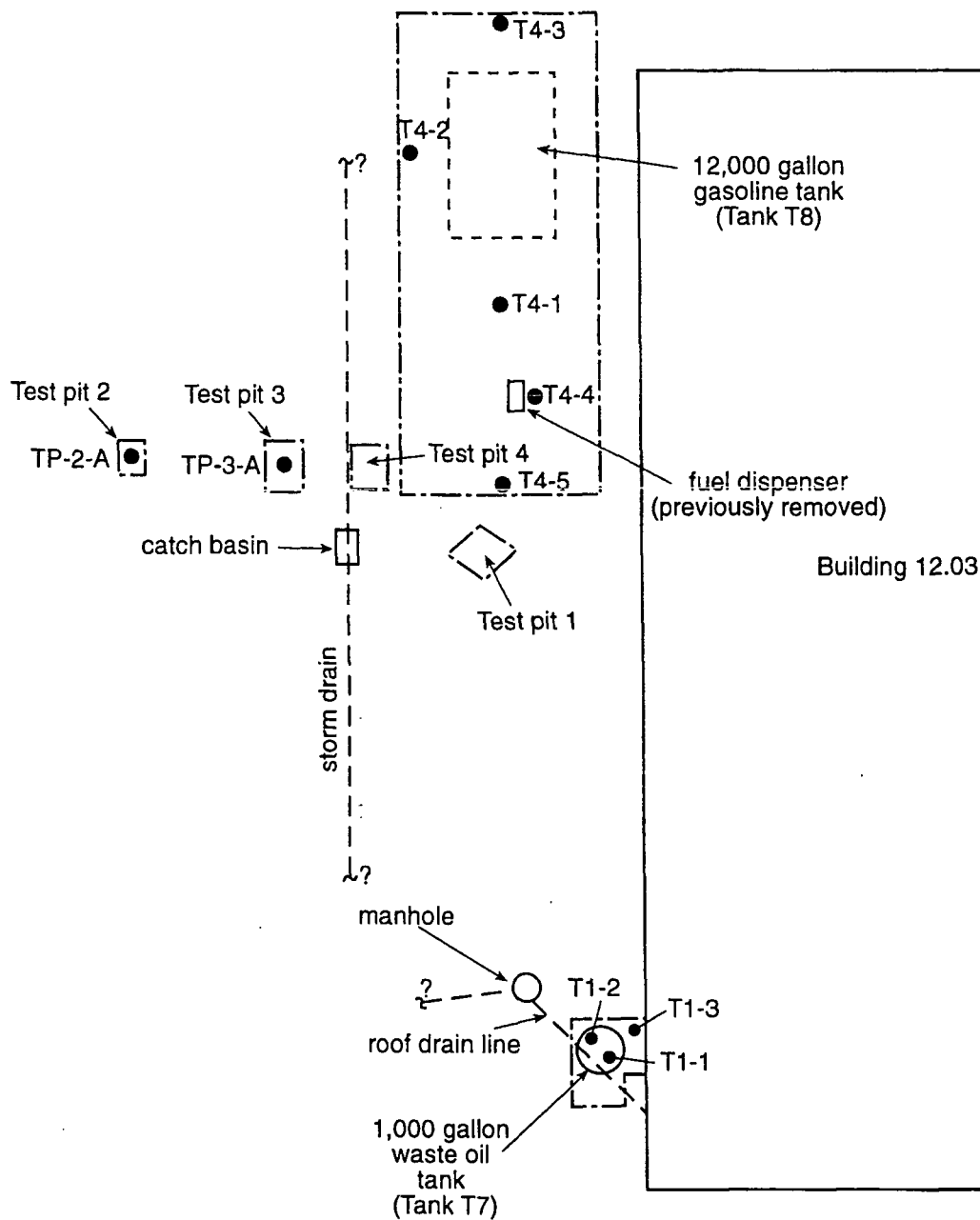


Figure 2. Site location map, Federal Center South, Seattle, Washington.



Legend

- T4 -1 ● Soil sample location
- Limits of excavation

0 30 feet
Approximate scale

Sample #	Depth	Sample #	Depth
T1-1	8.5	T4-5	5'
T1-2	8.5	TP-2-A	5.5'
T1-3	8.5	TP-3-A	5.5'
T4-1	5.4'		
T4-2	5.4'		
T4-3	5.4'		
T4-4	2.5'		

Source:
GSA Public Buildings Service -
UST Removal/Abandonment/
Replacement and AST Installation -
6/14/96 Drawing C-4.



Figure 3. Former waste oil tank T7 and gasoline tank T8 location map, Building 12.03 at Federal Center South, Seattle, Washington.

Geology and Hydrogeology

The Federal Center South site is situated within the Duwamish River Valley of the Puget Lowland physiographic region in Washington state. During the Pleistocene Epoch, the Puget Lowland underwent extensive and repeated glaciation. Generally, an ice sheet known as the Puget Lobe migrated southward from Canada into the Puget Lowland. Many present-day features and landforms are the result of ice scouring and deposition of glacial debris. As the glacial ice retreated in the late Pleistocene, thick sequences of glaciofluvial outwash and till, known as the Vashon Drift, were deposited. Recent fluvial deposits locally overlie glacial deposits from northwest-trending streams and rivers.

The Duwamish River valley is a north-trending trough situated between rounded hills composed almost exclusively of glacial deposits. The deposits observed and mapped along the river bank in this area consist of post-glacial alluvial deposits of an interlayered series of silt, sand, gravel, and organic material. The alluvial deposits in the Duwamish Valley are more than 100 feet thick and are intercalated with marine embayment sediments of sand and silt (Gaister 1991). Isolated pockets of peat and other organic material also are present in areas of accumulation in old meander channels and other depressions. Soils encountered during subsurface investigations conducted at the site consisted of alluvial deposits of silt with clay and organic material overlain by a medium- to coarse-grained sand layer. Much of the Duwamish River valley has been developed and modified using artificial fill consisting of mainly sediments of sand and silt. This fill material ranges in depth from less than 5 feet to more than 50 feet in old river channels. The Federal Center South site includes a top layer of fill material overlying the alluvial sand layer. This was found in portions of the site consisting primarily of sand with variable amounts of gravel ranging between 1 and 7 feet thick.

The site is situated along the east bank of the Duwamish Waterway, with the nearest tank approximately 100 feet east of the river bank, at an approximate elevation of 5 to 10 feet above mean sea level (USGS 1983). The topography of the site is relatively flat, with a slight gradual slope down to the west. Ground water encountered during drilling onsite ranged from 6.5 to 14 feet below ground surface. Ground water monitoring data has been collected from seven monitoring wells installed onsite, FC-1 through FC-7. Ground water surface elevation contours interpreted from monitoring data indicate that the shallow ground water flow direction generally is to the west-southwest toward the Duwamish Waterway, at an average hydraulic gradient of less than 0.01 feet per foot.

Direct infiltration and seepage from surface waters, precipitation, and surface runoff primarily recharges ground water in this area. The Federal Center South facility currently receives drinking water from the city of Seattle municipal water supply. Ground water beneath the site is not known to be used by the facility.

Tank Removal

In May 1998, EP Johnson Construction & Environmental (E.P. Johnson) of Pasco, Washington conducted underground storage tank decommissioning and closure activities at the Federal Center South facility. The tank removal process occurred over a three-day period from May 19 to May 21, 1998 with additional excavation of contaminated soil on May 27, 1998. The tanks removed from the site included:

- Tank T7—a spherical fiberglass UST seven feet in diameter, located immediately adjacent to the west side of building 12.03 (motor pool), beneath concrete paving (Figure 3). The 1,000-gallon former waste-oil tank was used by the motor pool for disposal of fluids during vehicle maintenance.
- Tank T8—a single-shelled steel UST, was located about 20 feet west of building 12.03, beneath concrete paving (Figure 5). The 12,000-gallon former gasoline tank provided fuel for motor pool vehicles. The tank measured 28 feet in length, with a diameter of eight feet. Piping consisted of a supply line that ran from the tank to the pump dispenser located about 12 feet south of the tank.

On May 19th, the tanks were inerted, the overlying soils removed from the top of the tanks, and remaining product pumped from the tanks. At tank location T8, soil contamination was evident near the dispenser piping. Holes were found in the suction piping, which ran about 15 feet from the tank to the dispenser. A petroleum odor was evident and a sheen was present on the water surface in the excavation after the tank was removed. About 80 cubic yards of contaminated soil was removed from the excavation and stockpiled immediately to the west. The final dimensions of the excavation measured 43 feet by 18 feet to a depth of about 7 feet below ground surface.

On May 20th the fuel dispenser area immediately south of tank T8 was overexcavated. The final dimensions of this excavation were about 23 feet by 18 feet to a depth of 5 feet below ground surface. On May 21, 1998, four test pits were excavated west of the dispenser excavation and samples collected to determine the extent of contamination in the fuel dispenser area.

About 10 cubic yards of contaminated soil were removed from the excavation at tank T7. Because this tank was initially to be closed in place, the tank was emptied and cleaned, then holes were drilled through the bottom, and samples collected about 10 inches below the tank. Samples also were collected from beneath the piping run. Stained soil was present beneath the tank, and it was determined that removal would not compromise the foundation of the adjacent building. Therefore, the fiberglass tank was removed, cleaned, and disposed of with other refuse from Federal Center South on May 21, 1998.

Results of two samples collected through the bottom of waste oil tank T7 indicated diesel-range hydrocarbon concentrations (4,000 mg/kg and 4,700 mg/kg) and heavy oil-range hydrocarbon concentrations (11,000 mg/kg and 12,000 mg/kg) exceeding MTCA method A cleanup criteria

(Figure 3). The sample collected beneath the fuel pipe had a heavy oil-range concentration (360 mg/kg) exceeding the MTCA cleanup criterion. The MTCA method A cleanup criteria for heavy metals were not exceeded in any of the samples submitted for this analysis.

Based on the diesel and heavy oil concentrations above regulatory cleanup levels found in this excavation, additional excavation and removal of contaminated soil was conducted later in April 1999 (see following section, Additional Soil Excavation).

Results of samples collected from the south, west, and north sides of gasoline tank T8 indicated gasoline-range hydrocarbons to the north with a concentration of 350 mg/kg, exceeding the MTCA method A cleanup level of 100 mg/kg (Figure 3). No gasoline constituents were detected above practical quantitation limits in the south or west side samples.

Results of two samples collected from the fuel dispenser area indicated gasoline-range hydrocarbons at concentrations of 120 and 700 mg/kg, both above the MTCA method A cleanup criterion. BTEX constituents also were detected in both samples, but only the xylenes concentration in one sample (66 mg/kg) exceeded the MTCA cleanup criterion.

No gasoline constituents were detected above practical quantitation limits from samples collected at two test pits excavated west of the dispenser area.

Total lead concentrations ranged from non-detect to 31 mg/kg in twelve samples collected during Tank T8 removal and from non-detect to 28 mg/kg in three samples collected at Tank T7. All results were below the MTCA method A soil cleanup level for lead at 250 mg/kg.

Because concentrations of gasoline-range hydrocarbons and xylenes exceeded cleanup criteria at the water table, particularly in the dispenser area, additional excavation and removal of contaminated soil was conducted later at the site in April 1999 (see following section Additional Soil Excavation).

Excavated Soil Disposal

Stockpiles of excavated soil from both tank excavations were sampled and found to contain petroleum hydrocarbon concentrations exceeding the MTCA cleanup criteria. Both stockpiles were hauled offsite for disposal by Remedco, Inc. Environmental Services of Seattle, Washington.

Initial Site Investigation Summary

In August 1998, following tank removal and closure assessment, a site investigation was initiated to further determine the extent of petroleum hydrocarbon contamination of soil and ground water downgradient from the former gasoline tank, waste oil tank, and fuel dispenser area. This site investigation was conducted to determine the need for further contaminated soil removal, and to determine the number and positions of monitoring wells to be installed for long-term monitoring. The site investigation consisted of drilling and collecting soil and ground water samples for chemical analysis at 15 locations across the impacted area using the push probe drilling method.

A detailed description of field procedures, including sample collection, handling, decontamination, and drilling, is presented in Appendix A of this report. Boring logs for all drilled holes are provided in Appendix B. Laboratory analytical reports for samples collected during the site investigation are provided in Appendix C. Photographic documentation of drilling activities and the site is provided in Appendix D.

Drilling and sampling activities were conducted on August 11, 1998. Herrera Environmental Consultants, Inc. collected soil and ground water samples for chemical analysis. Cascade Drilling, Inc. of Woodinville, Washington provided push probe drilling services, and OnSite Environmental Inc. of Redmond, Washington analyzed the samples for petroleum hydrocarbon constituents. Results of this investigation are described in the following sections.

Drilling and Sampling Procedures

The field investigation conducted at Federal Center South consisted of drilling and sampling soil and ground water from 15 push probe boring locations (GP-1 through GP-15; see Figure 4). Probe boring locations GP-1 through GP-3 were located to sample soil to the north and west, downgradient from gasoline tank T8. Probe boring locations GP-4 through GP-6 were located to sample soil and ground water near the former fuel dispenser. Probe boring locations GP-7 through GP-15 were located to assess soil and ground water quality for petroleum contaminants associated with waste oil tank T7.



Figure 4. Analytical results from probe borings at Federal Center South, Seattle, Washington.

Soil Sample Collection from Push Probe Borings

All 15 probe borings were drilled and sampled on August 11, 1998. Each probe boring was driven to a maximum depth ranging from 7 to 9 feet below ground surface. Soil samples were collected continuously at 2-foot depth intervals until ground water was encountered at approximately 6.5 feet below ground surface. Soil samples were retrieved using a decontaminated push drive soil-sampling probe. Soil samples were visually classified for lithologies, screened for the presence of volatile organic compounds using a photoionization detector, and observed for moisture content indicating the presence of ground water.

Based on field screening results, soil samples collected across the water table at seven probe boring locations (GP-1, GP-7, GP-8, GP-10, GP-12, GP-13, and GP-14) were stored in chilled coolers and submitted under chain-of-custody protocol to the laboratory for chemical analysis.

Ground Water Sample Collection from Push Probe Borings

Ground water samples were collected from five probe boring locations (GP-4, GP-9, GP-10, GP-11, and GP-15) drilled downgradient of the impacted areas relative to the assumed ground water flow direction. Samples were collected by driving a sealed stainless steel screened well point to the desired depth, opening the screen, and obtaining a water sample via dedicated tubing and peristaltic pump at the surface. Depth to water was determined by the field geologist based on observations of soil moisture content. Water samples were collected directly from the tubing into sample containers provided by the laboratory. Care was taken to ensure that no bubbles or headspace were present in the containers. Immediately upon filling, each container was securely capped, labeled, and placed in a chilled cooler for storage prior to delivery to the laboratory for analysis.

After soil and ground water samples were collected, boreholes were backfilled with bentonite chips, then sealed at the surface with asphalt.

Sample Analyses

The eight soil samples collected from probe borings located across the study area were analyzed for the presence of gasoline-range hydrocarbons using Ecology's NWTPH-G test method and BTEX constituents using U.S. EPA test method 8021. Samples collected from probe boring locations drilled in the vicinity of the waste oil tank T7 also were analyzed for the presence of diesel- and heavy oil-range hydrocarbons using Ecology's NWTPH-DX method. In addition to the petroleum hydrocarbon analyses, soil samples collected from probe borings GP-12 and GP-14 were analyzed for waste oil parameters including:

- Volatile organic compounds (VOCs) using U.S. EPA test method 8260
- Polynuclear aromatic hydrocarbons (PAHs) using U.S. EPA test method 8270

- Polychlorinated biphenyls (PCBs) using U.S. EPA test method 8082 (only analyzed on the sample from GP-14)
- Total metals for chromium and zinc using U.S. EPA test method 6010 (total RCRA metals analyses results for samples collected during tank removal did not indicate elevated concentrations of any constituent).

Water samples collected from probe borings GP-4, GP-9, GP-10, and GP-11 were submitted to the laboratory for gasoline-range hydrocarbon analysis using Ecology's NWTPH-G test method and BTEX constituents using U.S. EPA method 8021. The sample collected from probe boring GP-15 was analyzed for the presence of diesel- and heavy oil-range hydrocarbons using Ecology's NWTPH-DX test method.

Complete laboratory analytical packages for both soil and ground water samples, including sample chain-of-custody forms, are presented in Appendix C of this report.

Data Quality Assurance Review

The analysis of seven soil samples and six water samples for petroleum hydrocarbons and BTEX constituents was determined to be acceptable for use based on the following criteria:

Method Blanks—Methylene chloride, a common laboratory solvent, was detected at low concentrations in the method blank quality control sample, as well as in two soil samples analyzed for VOCs. No other contaminants were detected in any of the method blanks above the instrument detection limits.

Surrogate Recoveries—All of the undiluted samples had percent recoveries of surrogate compounds within acceptable control limit ranges.

Laboratory Control Spiked Samples—The lab analyzed spiked samples for diesel, and the percent recoveries for soil samples (84-85 percent) and water samples (91-93 percent) were acceptable. Percent recoveries for BTEX spiked soil samples (82-93 percent) and water samples (98-108 percent) were within acceptable spike control limits. Percent recoveries of five VOC compounds and eleven PAH compounds were within acceptable spike control limits. Percent recovery for the PCB spiked soil sample (92 percent) was within the spike control limit range (64-133 percent). Percent recoveries for chromium (93 percent) and zinc (101 percent) were within acceptable spike control limits.

Laboratory Duplicates—The lab analyzed two pairs of samples in duplicate for each matrix (soil and ground water) in which one sample pair was spiked with a known amount of analyte(s). The relative percent difference (RPD) values calculated from the percent recoveries of the BTEX-spiked pair for soil (82-93 percent; 1.3-1.7 percent RPD) and for water (93-108 percent; 0.58-1.2 percent RPD) are acceptable. An RPD value for each BTEX compound was not calculated for the paired quality control samples in soil

and ground water since no BTEX compounds were detected above the method reporting limit in any of the samples.

The RPD values calculated from the percent recoveries of the diesel spiked pair for soil (84-87 percent; 0.24-1.4 percent RPD) and for water (91-93 percent; 2.3 percent RPD) are acceptable. RPD values were not calculated for paired quality control samples in soil and ground water since diesel was not detected above method reporting limits in any of the samples.

The RPD values calculated from the percent recoveries of the VOC compounds in the matrix spike/matrix spike duplicate (MS/MSD) analysis for soil (1.6-13 percent RPD) are considered acceptable. RPD values (1.5-22 percent) for eleven PAH compounds in the soil MS/MSD analysis are acceptable. The RPD value (4.9 percent) calculated from the percent recovery of Aroclor 1260 PCB in the soil MS/MSD analysis is considered acceptable.

The RPD value calculated from the percent recoveries of chromium and zinc in the quality control analysis (17 percent and 6.5 percent, respectively) and in the MS/MSD analysis (2.1 percent and 2.6 percent) are considered acceptable.

Results of Initial Site Investigation

Subsurface Conditions

Based on findings from the 15 probe borings drilled during this investigation, and from previous observations during tank closure assessment, the site primarily is underlain by alluvial deposits. The alluvial deposits generally consist of alternate layers of dark brown to black medium-grained sand overlying a clayey silt unit. The alternate sand/silt unit was encountered in all 15 borings, starting beneath the asphalt paving and extending to depths of approximately 7 to 9 feet. The base of this sand/silt unit was not reached.

Yellowish-colored petroleum product was noted in soil samples retrieved at 5 feet below ground surface in probe boring GP-5. Hydrocarbon-like odors were noted in soil samples retrieved from seven of the fifteen borings from above the water table. Ground water was encountered during drilling at all 15 boring locations, with water level depths of 6.5 to 7.5 feet.

Soil Analytical Results

Petroleum hydrocarbon analytical results of soil samples collected from probe borings are presented in Table 1 and illustrated in Figure 4. Results were compared to method A cleanup levels listed under the MTCA cleanup regulation (Washington Administration Code [WAC] Chapter 173-360).

Results indicate a heavy oil concentration of 130 mg/kg detected in the sample collected at the 7-foot interval in probe boring GP-12, located within the former waste oil tank excavation. This heavy oil concentration is below the MTCA method A soil cleanup level of 200 mg/kg. No other petroleum hydrocarbon constituents were detected above practical quantitation limits in any of the samples.

Table 1. Petroleum hydrocarbon results of soil samples collected from probe borings drilled at Federal Center South, Seattle, Washington (mg/kg).

Sample Identification	Gasoline	Diesel	Heavy Oil	Benzene	Toluene	Ethylbenzene	Xylenes
MTCA method A cleanup level ^a	100	200	200	0.5	40	20	20
GP1	(6.0)	—	—	(0.060)	(0.060)	(0.060)	(0.060)
GP7	(5.7)	68	170	(0.057)	(0.057)	(0.057)	(0.057)
GP8	(32)	—	—	(0.32)	(0.32)	(0.32)	(0.32)
GP10	(6.3)	—	—	(0.063)	(0.063)	(0.063)	(0.063)
GP12	—	(32)	130	—	—	—	—
GP13	—	(32)	(63)	—	—	—	—
GP14	—	(31)	(63)	—	—	—	—

Refer to Figure 4 for sample locations.

Values reported in milligrams per kilogram (mg/kg) on a dry weight basis.

(6.0) Constituent not found above enclosed practical quantitation limit.

— Sample was not analyzed for this constituent.

^a MTCA—Model Toxics Control Act cleanup regulation (Department of Ecology publication 94-06, 1996).

Results of soil samples collected for waste oil parameters in borings GP-12 and GP-14 indicated methylene chloride concentrations of 0.28 mg/kg and 0.088 mg/kg, respectively. Methylene chloride, commonly used as a laboratory solvent, also was detected in the method blank, indicating the detection in the samples was due to laboratory contamination. No other VOC compounds, PAH compounds, or PCBs were detected above practical quantitation limits in either sample.

Both soil samples also were analyzed for the presence of chromium and zinc; the results are presented in Table 2 and illustrated in Figure 4. Low concentrations of both metals were detected in both samples, with neither result exceeding MTCA method A (for chromium) nor B (for zinc) cleanup levels.

Table 2. Metal results of samples collected from probe borings at Federal Center South, Seattle, Washington (mg/kg).

Sample Identification and Depth	Chromium	Zinc
<i>MTCA soil cleanup levels</i>	100 ^a	96,000 ^b
GP12-7	6.5	23
GP14-5	6.1	12

Values reported in milligrams per kilogram (mg/kg) on a dry weight basis.

^a Chromium cleanup level in soil as established in MTCA—Model Toxics Control Act method A cleanup regulation (Department of Ecology publication 94-06, 1996a).

^b Zinc cleanup level in soil as established in MTCA method B cleanup regulation (Department of Ecology publication 94-145, 1996b).

Ground Water Analytical Results

Petroleum hydrocarbon analytical results for ground water samples collected from probe borings are presented in Table 3 and illustrated in Figure 4. Results were compared to MTCA method A ground water cleanup levels.

Results indicate a benzene concentration of 13 µg/L detected in the water sample collected from probe boring GP-4, located 70 feet due west of the former dispenser island. This benzene concentration exceeds the MTCA method A cleanup level of 5 µg/L. Gasoline-range hydrocarbons (130 µg/L) and xylenes (1.2 µg/L) also were detected in GP-4, both below cleanup criteria. Benzene concentrations were detected in samples collected from probe borings GP-9 (3.7 µg/L) and GP-11 (2.5 µg/L), both below the regulatory cleanup criterion. No petroleum hydrocarbon constituents were detected above practical quantitation limits in samples collected from probe borings GP-3, GP-10, and GP-15.

Table 3. Petroleum hydrocarbon results of ground water samples collected from probe borings at Federal Center South, Seattle, Washington (µg/L).

Sample Identification	Gasoline	Diesel	Heavy Oil	Benzene	Toluene	Ethylbenzene	Xylenes
<i>MTCA method A cleanup level ^a</i>	1,000	1,000	1,000	5.0	40	30	20
GP3-W1	(100)	—	—	(1.0)	(1.0)	(1.0)	(1.0)
GP4-W1	130	—	—	13	(1.0)	(1.0)	1.2
GP9-W1	(100)	—	—	3.7	(1.0)	(1.0)	(1.0)
GP10-W1	(100)	—	—	(1.0)	(1.0)	(1.0)	(1.0)
GP11-W1	(100)	—	—	2.5	(1.0)	(1.0)	(1.0)
GP15-W1	—	(250)	(500)	—	—	—	—

Refer to Figure 4 for sample locations.

Values reported in micrograms per liter (µg/L).

Results exceeding cleanup levels are printed in boldface type.

(100) Constituent not found above enclosed practical quantitation limit.

— Sample was not analyzed for this constituent.

^a MTCA—Model Toxics Control Act cleanup regulation (Department of Ecology publication 94-06, 1996).

Additional Soil Excavation

On April 14 and 15, 1999, E.P. Johnson Construction and Environmental, Inc. of Pasco, Washington conducted excavation activities at the Federal Center South site, including removal of petroleum-contaminated soil from the dispenser area and the area immediately west of the waste oil tank. Herrera Environmental Consultants, Inc. of Seattle, Washington performed oversight of removal activities. Excavation areas are shown in Figure 5. Photographs taken during excavation activities are presented in Appendix D. Weigh tickets for disposal of 416 tons of petroleum-contaminated soil by Remedco at the Waste Management Inc. facility in Seattle, are provided in Appendix E.

Dispenser Area Excavation

Excavation of the dispenser area located immediately south of former gasoline tank T8 was performed on April 14, 1999. The excavation area was identified and marked onsite immediately south of the former dispenser, based on results from the initial site investigation and tank removal observations. The asphalt paving first was saw-cut, removed, and stockpiled for disposal. The top 2 feet of soil beneath the asphalt paving was excavated and stockpiled onto plastic sheeting. This material was considered to be clean, since it came from near the surface and was downgradient of deeper sources. Observations during removal did not identify visual or odiferous indications of contamination. The soil eventually was placed back in the excavation along with clean imported backfill.

Soil removed from beneath the designated clean overburden was loaded directly onto trucks for removal offsite. Final excavation pit dimensions were approximately 35 feet by 38 feet, and approximately 7 feet deep (Figure 5). Ground water seeped into the excavation and stabilized at approximately 6.5 feet below ground surface. Soil consisted of slightly silty medium-grained sand and silt.

Waste Oil Tank Area Excavation

Removal of petroleum-contaminated soils at the former waste oil tank T7 location was performed on April 15, 1999. Asphalt paving was saw-cut, removed, and stockpiled for disposal. Final excavation pit dimensions were approximately 15 feet by 26 feet and approximately 7 feet deep (Figure 5). Ground water seeped into the excavation and stabilized at approximately 6.5 feet below ground surface. Soil removed from the waste oil area excavation was similar in lithology to soils removed from the dispenser area excavation. Further overexcavation on the east end of the pit was limited, due to the presence of the building wall and foundation.

Excavation Backfill Activities

Soon after petroleum-contaminated soils were excavated to the extent possible, both pit excavations first were lined with a non-woven geotextile filter fabric, and then backfilled with pea gravel from bottom to approximately 2 to 3 feet below ground surface. The filter fabric then was folded on top of the pea gravel. The overburden soil excavated from the dispenser area excavation was placed on top of the filter fabric/pea gravel backfill in that excavation. A layer of coarse crushed gravel base material was placed on top of the backfill material in both pit excavations, and then the surface was sealed with a 4-inch layer of asphalt.

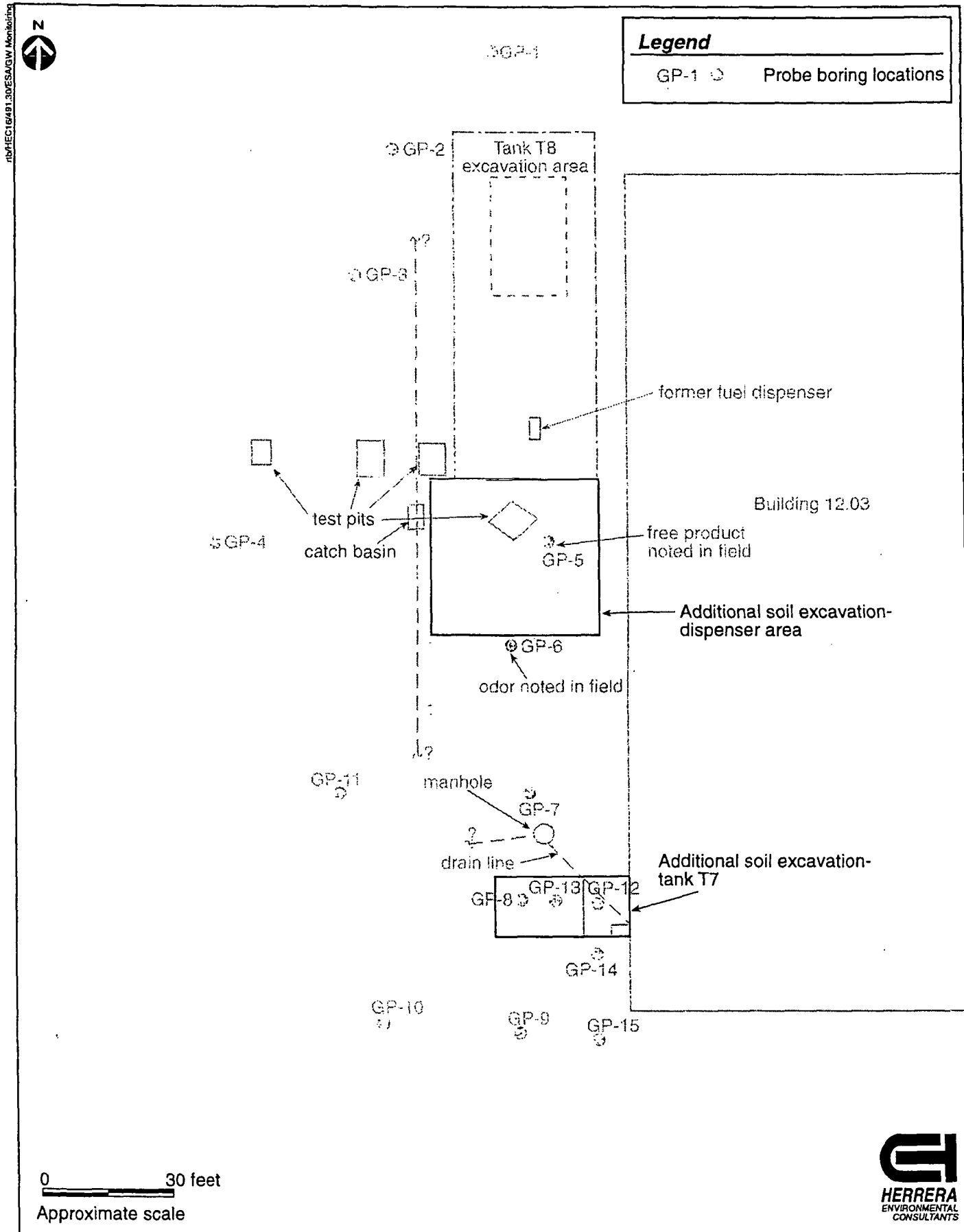


Figure 5. Areas of additional soil excavation near tanks T7 and T8 at Federal Center South, Seattle, Washington.

Monitoring Program Summary

In June and July 1999, following the excavation and removal of contaminated soil, further site characterization and a ground water monitoring program were initiated at the Federal Center South site. The purpose of the investigation was to characterize and determine the extent of petroleum hydrocarbon contamination of soil and ground water downgradient of the dispenser area and waste oil tank and to further define the ground water flow direction and gradient beneath the site. A ground water monitoring program was set up to track movement of contaminants over time. The work included:

- Drilling and installing seven ground water monitoring wells, FC-1 through FC-7
- Analysis of the ground water flow direction and gradient beneath the site
- Sampling of ground water at all seven wells for petroleum hydrocarbon constituents
- Monitoring and sampling ground water at all seven wells to evaluate ground water quality trends.

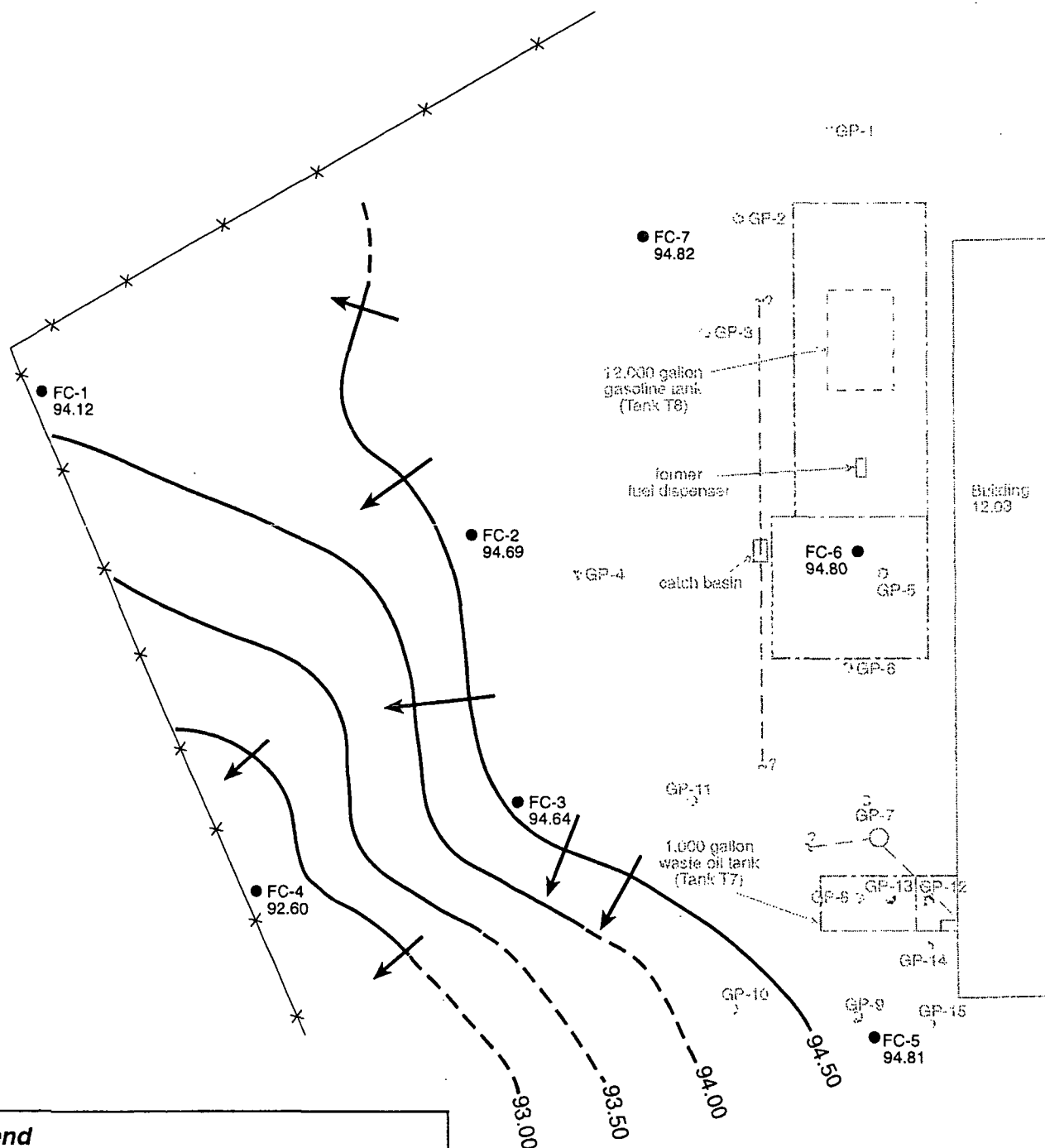
Appendix A presents a detailed description of field procedures, including sample collection and handling, drilling activities, monitoring well installation, and decontamination. Boring logs and well construction details are provided in Appendix B. Laboratory analytical reports for ground water samples are provided in Appendix F.

Drilling, well installation, and sampling activities were conducted on June 30 and July 1, 1999, and ground water samples were collected on July 6, 1999 by Herrera Environmental Consultants, Inc. Cascade Drilling, Inc. of Woodinville, Washington provided hollow-stem auger drilling and well installation services. OnSite Environmental Inc. of Redmond, Washington analyzed ground water samples for petroleum hydrocarbon constituents.

Sample Locations and Methods

Drilling and Well Installation

Seven ground water monitoring wells (FC-1 through FC-7) were drilled and installed at the Federal Center South site (Figure 6). Monitoring wells FC-1 through FC-4 were positioned west-southwest and downgradient of the estimated extent of petroleum hydrocarbon-contaminated ground water determined by previous investigations. Monitoring well FC-5 was positioned south of the waste oil tank area. Monitoring well FC-6 was positioned within the former dispenser area at the source of contamination. Monitoring well FC-7 was positioned to the northwest of the former gasoline tank location. Soil samples from each boring were collected



Legend

- FC-5 ● Monitoring well locations
- GP-1 ○ Probe boring locations
- ↙ Estimated direction of ground water flow
- (94.12) Ground water surface elevations as measured on 07/06/99
- Ground water surface contour line
- - - Inferred ground water surface contour line

0 40 feet

Approximate scale



Figure 6. Water level contour map, July 6, 1999, Federal Center South, Seattle, Washington.

at 5-foot intervals using a decontaminated drive split-spoon sampler. Samples from each interval were visually classified for soil lithologies, screened for the presence of volatile organic compounds using a photoionization detector, and observed for moisture content indicating the presence of ground water. All seven borings were drilled and sampled to a total depth of 16.5 feet. Each boring was completed as a ground water monitoring well with a 10-foot screen section at the base, with each well installed at a total depth of 15 feet below ground surface. Each well was completed below grade in a watertight, traffic-rated well monument box. Ground water samples were collected from all seven monitoring wells on July 6, 1999, stored in chilled coolers, and then submitted to the laboratory for chemical analysis.

Sample Analyses

Samples collected during the initial ground water monitoring/sampling event were analyzed for petroleum hydrocarbon constituents by OnSite Environmental Inc. of Redmond, Washington using the following test methods:

- Total petroleum hydrocarbons in the gasoline-range (NWTPH-G) test method quantified against a gasoline-range hydrocarbon standard
- Benzene, toluene, ethylbenzene, and xylenes constituents (BTEX) using U.S. Environmental Protection Agency (U.S. EPA) 8020 test method.

In addition to these analyses, samples collected from wells FC-4, FC-5, and FC-6 were analyzed for the presence of diesel- and heavy oil-range hydrocarbons using Ecology's NWTPH-DX (extended) test method, quantified against diesel- and heavy oil-range hydrocarbon standards.

Complete laboratory analytical packages for ground water samples, including sample chain-of-custody forms, are included in Appendix F.

Data Quality Assurance Review

The analysis of seven ground water samples collected from wells FC-1 through FC-7 for TPH and BTEX analyses were determined to be acceptable for use based on the following criteria:

Method Blanks—There were no contaminants in the blanks detected above the instrument detection limit.

Surrogate Recoveries—All the undiluted samples had percent recoveries of surrogate compound fluorobenzene within the control limit range (50 to 150 percent recovery) for NWTPH-G and BTEX test methods, and o-terphenyl within the control limit range (50 to 150 percent recovery) for the NWTPH-DX test method.

Laboratory Control Spiked Samples—Percent recoveries of BTEX compounds in the MS/MSD analysis (90 to 93 percent recoveries) were within quality control limits.

Laboratory Duplicates—The RPD value (7.4 percent) calculated from the percent recovery of benzene in the quality control sample pair is acceptable. RPD values calculated from the percent recoveries of BTEX compounds in the spiked sample pair (0.24 to 1.0 percent RPD) are considered acceptable. An RPD value was not calculated from the diesel fuel quality control sample pair since no diesel-range hydrocarbons were detected above practical quantitation limits in either sample.

Laboratory Flags—The laboratory flagged the gasoline-range hydrocarbon concentration (500 µg/L) detected in samples collected from well FC-6 because the sample chromatogram does not match the chromatogram of the gasoline-range hydrocarbon standard. The lab identified the contaminant as either a weathered gasoline or diesel #1 fuel based on the sample chromatogram (OnSite 1999).

Results

Subsurface Soil Conditions

Based on findings from the seven well borings drilled during this investigation, and from 15 push probe borings and excavations conducted as part of previous investigations, the site primarily is underlain by alluvial deposits that generally consist of alternate layers of brown medium-grained sand and gray silt with variable amounts of clay and organic material. This alternate sand/silt unit is consistent with the soil lithology described from previous investigations as alluvial deposits. The sand/silt unit was encountered in all seven borings, starting immediately beneath the asphalt paving in five of the seven borings, and extending to the bottom depths of each boring at 16.5 feet. The base of the sand/silt unit was not reached in any of the borings. Crushed gravel fill material used to backfill the pit excavation, generated by excavating the contaminated soil within the dispenser area, was encountered overlying the sand/silt unit in boring FC-6, starting beneath the asphalt paving and extending to a depth of approximately 5 feet. Fill material also was encountered in boring FC-1, starting beneath the asphalt paving and extending to a depth of approximately 7 feet. Fill material in this boring consisted of coarse-grained sand with fine-grained gravel.

Hydrocarbon-like odors were noted in samples collected at the 5-foot interval retrieved from boring FC-6, positioned within the source area. No soil staining or hydrocarbon-like odors were noted in any samples retrieved from the remaining six borings. Photoionization detector readings above background levels were detected in samples collected from boring FC-1, ranging from 4.4 to 5.5 parts per million (ppm); boring FC-2, ranging from 4.8 to 8.8 ppm; boring FC-3, ranging from 7.2 to 14.5 ppm; and boring FC-6, ranging from non-detect to 21 ppm. No photoionization detector readings above background were detected in samples collected from borings FC-4, FC-5, or FC-7.

Site Ground Water Conditions—July 6, 1999

Ground water was encountered during drilling at all seven well boring locations at depths ranging from approximately 9 to 14 feet. Five days later, ground water was measured at depths ranging between 4.96 and 6.09 feet below reference elevation points at the top of each well casing (Table 4). Ground water elevation measurements collected from these wells indicate ground water flow direction is generally to the west-southwest, with an average hydraulic gradient of less than 0.01 feet per foot (Figure 6).

Table 4. Ground water surface elevation data collected on July 6, 1999 from monitoring wells at Federal Center South site, Seattle, Washington.

Monitoring Well Identification	Reference Point Elevation ^a (feet)	Depth to Water ^b (feet)	Water Level Elevation (feet)
FC-1	99.23	5.11	94.12
FC-2	100.59	5.90	94.69
FC-3	100.73	6.09	94.64
FC-4	98.65	6.05	92.60
FC-5	100.29	5.48	94.81
FC-6	99.76	4.96	94.80
FC-7	100.00	5.18	94.82

^a Elevations of reference points (top of well casing) were surveyed relative to a temporary datum (well FC-7) with assigned elevation of 100.00 feet.

^b Depth to water measurements were taken from reference point marks on top of well casing.

Ground Water Analytical Results—July 6, 1999

Ground water samples were collected for chemical analysis from all seven wells on July 6, 1999. Analytical results for these samples are summarized in Table 5 and illustrated in Figure 7. Results are compared to method A cleanup levels for TPH and BTEX constituents listed in the Washington state Department of Ecology MTCA cleanup regulation (Ecology 1996a).

Analytical results indicate benzene (5.1 µg/L), ethylbenzene (91 µg/L), and xylenes (175 µg/L) present in ground water collected from well FC-2 at concentrations above the MTCA method A cleanup levels of 5 µg/L, 30 µg/L, and 20 µg/L, respectively. Gasoline-range hydrocarbons and toluene also were detected in well FC-2 at concentrations below the regulatory cleanup criteria. Other hydrocarbon constituents present at concentrations below the MTCA method A cleanup levels include benzene (3.5 µg/L) in well FC-3; heavy oil-range hydrocarbons (520 µg/L) in well FC-4; and gasoline-range hydrocarbons (500 µg/L), ethylbenzene (19 µg/L), and xylenes (9.4 µg/L) in well FC-6. No gasoline- and/or diesel- and heavy oil-range hydrocarbons or BTEX constituents were detected above practical quantitation limits in samples collected from FC-1, FC-5, and FC-7.



Figure 7. Petroleum hydrocarbon results for ground water samples collected on July 6, 1999 from wells at Federal Center South, Seattle, Washington.

Table 5. Petroleum hydrocarbons and BTEX results of ground water samples collected on July 6, 1999 from monitoring wells at the Federal Center South site ($\mu\text{g/L}$).

Sample Identification	Gasoline Range Hydrocarbons	Diesel Range Hydrocarbons	Heavy Oil Range Hydrocarbons	Benzene	Toluene	Ethylbenzene	Xylenes
<i>MTCA method A cleanup level^a</i>	<i>1,000</i>	<i>1,000</i>	<i>1,000</i>	<i>5</i>	<i>40</i>	<i>30</i>	<i>20</i>
FC-1	(100)	—	—	(1.0)	(1.0)	(1.0)	(1.0)
FC-2	820	—	—	5.1	12	91	175
FC-3	(100)	(250)	(500)	3.5	(1.0)	(1.0)	(1.0)
FC-4	(100)	(250)	520	(1.0)	(1.0)	(1.0)	(1.0)
FC-5	(100)	(250)	(500)	(1.0)	(1.0)	(1.0)	(1.0)
FC-6	500	—	—	(1.0)	(1.0)	19	9.4
FC-7	(100)	—	—	(1.0)	(1.0)	(1.0)	(1.0)

Values reported in micrograms per liter ($\mu\text{g/L}$).

(1.0) indicates constituent not found above the enclosed practical quantitation limit.

— Sample was not analyzed for this constituent.

Values exceeding MTCA cleanup levels are shown in boldface type.

^a MTCA—Model Toxics Control Act cleanup regulation (Ecology 1996a).

Conclusions

A two-phase site investigation was conducted at Federal Center South to determine the extent of petroleum hydrocarbon contamination in soil and ground water associated with releases from two underground tank systems. Based on results of the initial site investigation, additional excavation and removal of contaminated soil from the dispenser area and waste oil tank location was performed. Seven monitoring wells were installed during the follow-up investigation as a basis for long-term ground water monitoring. Investigation results indicate the following:

- Gasoline contamination in excess of regulatory cleanup criteria detected in samples collected in the vicinity of the former dispenser area south of gasoline tank T8 appears to be the result of leakage from suction piping that ran approximately 15 feet between the fuel dispenser and the tank.
- Diesel and heavy oil contamination in excess of regulatory cleanup criteria found in soil surrounding the waste oil tank T7 most likely is a result of overfill and spillage.
- Ground water flow direction generally is to the west-southwest, with an average hydraulic gradient of less than 0.01 feet per foot (based on July 1999 ground water elevation data).
- Benzene, ethylbenzene, and xylenes contamination in ground water at well FC-2 exceeded MTCA method A cleanup levels. This well is positioned approximately 70 feet west of the former dispenser area. Samples collected from the remaining six wells either had petroleum contaminant concentrations below the MTCA method A cleanup levels, or had no hydrocarbon constituents detected above practical quantitation limits.

Ground water monitoring from the seven wells will continue on a quarterly basis for a period of three years, to further assess the effectiveness of the cleanup action performed at the site. The monitoring program will assess whether residual hydrocarbon-contaminated ground water in the vicinity of the dispenser area and waste oil tank location is migrating, and whether concentrations are decreasing. An assessment will be made after several additional monitoring events to determine whether further cleanup action or monitoring is required at this site.

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APPENDIX A

Field Procedures

Field Procedures

This appendix documents the procedures used to perform the field investigations described in this report. The discussion includes information on the following subjects:

- Drilling and soil and ground water sampling via push probe drilling method
- Drilling, soil sampling, and well installation via hollow-stem auger drilling method
- Ground water sampling procedures at monitoring wells
- Sample jars, sample handling, and chain-of-custody procedures
- Field equipment decontamination procedures
- Investigation-derived waste disposal.

Boring logs from both probe and hollow-stem auger drilling and well construction details are included in Appendix B. Field procedures for site investigations were implemented in general accordance with U.S. Environmental Protection Agency (EPA) and Washington state Department of Ecology-established sample handling protocols.

The initial field investigation consisted of drilling fifteen probe borings and collecting soil and ground water samples for laboratory analysis. The follow-up field investigation consisted of drilling and installing seven monitoring wells and collecting ground water samples for laboratory analysis. Field procedures for performing this work are presented in the following sections.

Sample Designation

Samples were designated by a four-digit alphanumeric system referencing the general site location and sample number within the location. Soil samples collected from the probe borings received an additional suffix denoting the depth of the sample interval. For example:

- GP7-5 denotes the soil sample collected at probe boring location 7, starting at a depth of 5 feet.

Water samples collected from the probe borings received an additional suffix “-W1” denoting water sample collected during the initial investigation. For example:

- GP9-W1 denotes the water sample collected at probe boring location 9 during the initial investigation.

Ground water monitoring samples were designated by a four-digit alphanumeric system referencing the general site location and a number denoting the sampling event from which the samples were collected. For example:

- FC4-1 denotes the ground water sample collected at Federal Center South monitoring well location 4, collected during sampling event 1 on July 6, 1999.

Sampling Procedures

Pre-Drilling Activities

Prior to commencing drilling activities, a private utility locating company, Applied Professional Services, Inc. of Issaquah, Washington, was retained to locate underground utilities at each proposed boring location situated on private property. Facility plan drawings also were reviewed, as supplied by U.S. GSA.

Soil Sampling from Probe-Drilled Borings

Probe borings were advanced using a probe-drive sampler attached to driven probe rods. All 15 boring locations were drilled to maximum depths of 7 to 9 feet below ground surface, when ground water was encountered. During drilling, discrete soil samples for soil classification, field screening, and chemical analysis were collected continuously at 2-foot intervals using a probe-drive sampler 2 feet long by 2 inches outside diameter and lined with dedicated clear Lexan® liners. The sampler was sealed with a piston stop pin while being pushed or driven to the desired sampling depth. The piston stop pin was retracted into the sampler while the sampler was pushed or driven to obtain a soil sample. Following retrieval, the soil-filled Lexan liner was removed from the sampler and cut open to expose the soil core. Each soil core sample was logged by a geologist for lithologies and field-screened for indications of contamination. Soil encountered during drilling was visually classified in accordance with the Unified Soil Classification System (USCS; American Society for Testing and Materials [ASTM] D2488-90).

Collected soil samples were field-screened for the presence of volatile organic vapors using a Photovac® Microtip 2020 photoionization detector (PID). The PID is designed to detect and measure volatile organic compound vapors in air. The PID was calibrated in the field using 100 parts per million (ppm) isobutylene standard gas. Pertinent geologic and hydrogeologic subsurface conditions and PID readings were recorded on boring logs (Appendix B).

Soil samples selected for chemical analysis were prepared by removing the soil from the sampler, with placement into jars provided by the analytical laboratory. Each sample was uniquely labeled denoting the sample identification number and sample depth interval, date and time sampled, and job number. Soil samples were then placed in a chilled cooler for storage prior to delivery to the analytical laboratory. Soil samples collected at the 5- to 7-foot depth interval at probe borings GP-1, GP-7, GP-8, GP-10, GP-13, and GP-14, and at the 7- to 9-foot depth interval at probe boring GP-12 were submitted to the laboratory for chemical analysis based on field screening results. No soil samples collected from the remaining eight probe borings were submitted to the laboratory for analysis; ground water samples were collected from six of these borings instead.

Ground Water Sampling from Push Probe Boring

Ground water samples were collected from six push probe boring locations. Sampling consisted of driving a sealed stainless steel screened well point to the desired depth, opening the screen, and obtaining a water sample via dedicated tubing and peristaltic pump at the surface. The screened well point was positioned below the water table, with depth to water determined by the field geologist based on observation in soil moisture content in samples collected at each location. General procedures for collecting ground water samples from push probe borings were as follows:

1. The screened well point sampler assembly was attached to the probe rods by the driller. The screened well point sampler was then driven below the water table using the same probe hole used to collect soil samples.
2. The screened well point sampler was then pushed out from its enclosed sheath into the formation at the desired depth.
3. Flexible polyethylene tubing was threaded through the probe rods down to the screened well point sampler. Water from the screened interval was pumped up to the surface using a peristaltic pump.
4. Samples were collected directly from the tubing into sample containers provided by the analytical laboratory. Care was taken to ensure that no bubbles or headspace were present. Immediately upon filling, each container was securely capped, labeled, and placed into a chilled cooler for storage prior to delivery to the analytical laboratory. The date and time of each sample collected was recorded in the field notebook and on the chain-of-custody form.
5. The tubing used for sampling ground water from the screened well point sampler was pulled out and disposed of with other incidental waste (e.g. used nitrile gloves, paper towels). The screened well point sampler components were decontaminated between each probe boring following the procedures described later in this section.

Water samples collected from probe boring locations GP-3, GP-4, GP-9, GP-10, GP-11, and GP-15 were placed into a chilled cooler for storage and then submitted to the laboratory for chemical analysis.

After drilling and sampling of soil and/or ground water from each probe boring location, boreholes were backfilled from the bottom to the ground surface with bentonite chips and then capped at the surface with asphalt.

Soil Sampling from Auger Drilled Soil Borings

Seven wells were installed during the follow-up investigation using the hollow-stem auger drilling method. Borings were completed using an auger drill rig equipped with 4.25-inch inside diameter hollow-stem auger flights. Discrete soil samples for soil classification were collected at

5-foot intervals using a drive split-spoon sampler 18 inches long by 2-inch outside diameter. The sampler was driven using a 140-pound downhole jaw hammer with a drop of 30 inches. Following retrieval, each sample was logged by a geologist for soil lithologies, field screened for indications of contamination using a PID, and observed for moisture content for indications of ground water. Soil encountered during drilling was visually classified in accordance with the Unified Soil Classification System (ASTM D2488-90). Pertinent geologic and hydrogeologic subsurface conditions and PID readings were recorded on soil boring logs (Appendix B).

Monitoring Well Installation

Monitoring wells were constructed of 2-inch inside diameter Schedule 40 polyvinyl chloride (PVC) blank casing flush threaded to 0.010-inch slot machine cut PVC well screen casing. All wells were sealed with flush threaded PVC bottom caps and secured at the top with a locking expansion plug-type cap and padlock.

All seven wells were installed to a maximum depth of 15 feet. Location of the screened interval was determined in the field based on indication of water level observed during drilling. A filter pack of clean #2/12-graded silica sand was placed in the annular space between the casing and borehole to a height approximately 2 feet above the top of the slotted well casing. Bentonite chips were placed above the filter pack to within 2 feet of the ground surface. The remaining portion of each boring was filled with concrete to a point just below the top of the well casing. The well was completed with a traffic-rated monument that extends slightly above the ground surface, so that surface water run-off will be routed away from the well head. The monument was set in and finished at the surface with concrete. Well construction details are provided on boring logs in Appendix B.

Well Development

Following installation, monitoring wells were developed through a combination of surging and pumping. Development continued until levels of sand and silt were reduced and water removed from the well was generally of clear quality. Development water from each well was contained in 55-gallon drums and stored temporarily at the site.

Ground Water Sampling from Monitoring Wells

General procedures for collecting ground water samples from wells were as follows:

1. Remove the well monument cover and inspect the condition of the well and surrounding area. Note observations in the field notebook and well sampling log. Unlock and remove the well casing plug.
2. Using an electronic water level meter, the depth to ground water was measured to the nearest 0.01 feet. Measurements were taken relative to the surveyed reference mark at the top of the PVC well casing. Date, time, and measurements were recorded in the field notebook and well sampling log.

3. The well was purged of standing water using a dedicated disposable high-density polyethylene bailer attached to clean nylon twine that was lowered into the well to the screened interval. During purging, pH, water temperature, and specific conductivity were measured. The amount of water purged, field measurements, and time of collection were recorded in the field notebook and well sampling log. The well was purged until field readings had stabilized, with a minimum of three casing volumes of standing water removed prior to sampling. Purged water removed during development was contained in 55-gallon drums temporarily stored onsite along the fence near well FC-1.
4. Following purging, samples were collected using the same dedicated disposable bailer used to purge the well. Samples were collected by gently lowering the bailer into the well, retrieving the bailer to the surface, and pouring the contents of the bailer directly into sample containers provided by the analytical laboratory. Care was taken to ensure that no bubbles or headspace were present. Containers were securely capped, labeled, and placed into a chilled cooler for storage prior to delivery to the laboratory. The date and time of each sample collected was recorded in the field notebook, well sampling log, and on the chain-of-custody form.
5. The well casing plug was replaced and locked, and the well monument cover was secured.

Survey Locations and Elevations

A scaled site map was drawn, including locations of all wells and other site features based on a site map provided by U.S. GSA. Well locations and other site features were located by measuring distances from reference points using a measuring tape. Distance measurements for the well locations and site features were plotted on the base site map.

Survey elevations of the reference mark on top of each well casing were collected following well installation using an auto leveler, tripod, and a level rod with graduations in feet and decimals. Wellhead elevations were measured and calculated to the nearest 0.01 foot and recorded in the field notebook. The wellhead reference mark at well location FC-7 was used as a temporary benchmark with assigned elevation of 100.00 feet.

Decontamination Procedures

Decontamination was performed on all sampling equipment potentially exposed to contaminated soil and ground water prior to leaving each area of concern. All sampling equipment, except for Lexan liners and disposable bailers, was decontaminated prior to entry in the field. In addition, chemical-resistant gloves worn by sample handlers were changed between sampling locations.

Decontamination of Soil Sampling Equipment

The following decontamination procedure was used for soil sampling equipment, including push probe drive sampler, split-spoon sampler, sampling spoons, and mixing bowls:

- Rinse with tap water
- Scrub with water and Alconox detergent
- Rinse with tap water
- Rinse with distilled water
- Air dry thoroughly.

Decontamination of Drilling Equipment

Drilling equipment, including sections of push-drive probe rods and screened well point samplers, hollow-stem auger flights and other downhole drilling equipment were decontaminated between boring locations using a high-temperature pressure washer. All decontamination fluids generated during pressure washing drilling equipment were contained in a 55-gallon drum temporarily stored onsite along the fence in the vicinity of monitoring well FC-1.

Sample Handling

All samples collected during this investigation were handled according to the procedures described in this section.

Sample Containers and Labeling

Samples were placed in containers supplied by the analytical laboratory appropriate for the analyses to be performed. Sample container labels were completed at the time of collection using a permanent waterproof pen or marker. Sample labels included the following information:

- Project name
- Sample identification (including site designation, sample number, and depth interval collected)
- Date and time of collection
- Initials of sampling personnel
- General analysis to be performed.

Sample Storage

Immediately following sample collection, sample containers were placed into a chilled cooler for storage prior to delivery to the analytical laboratory. Care was taken to ensure that sample

holding times were not exceeded during periods of storage. Sample containers were placed into plastic Ziploc bags to protect labels from moisture in the cooler.

Chain of Custody

Following collection, sample information was recorded on a chain-of-custody form. The purpose of this record is to account for the possession (or custody) of each sample from the time it is collected until laboratory testing and reporting is complete. The signature of each person in possession of the samples must be recorded on the chain-of-custody form. Information recorded on the chain-of-custody record included the following:

- Project name and location
- Project number
- Names of project manager and sampling personnel
- Sample identification
- Sample matrix (soil or water)
- Date and time of collection (for each sample)
- Analysis requested (for each sample)
- Number of sample containers (for each sample)
- Signature, date, and time (for each person releasing or accepting sample custody).

Sample Shipment and Delivery

Samples collected during this investigation were hand-delivered to the analytical laboratory.

Sample Documentation

All sampling activities during this investigation were documented in a dedicated field notebook. The notebook was labeled with the project name, project identification number, dates of field activities, and name of the field coordinator. All relevant activities were recorded in the field notebook during the period of the field investigation. Entries into the field notebook were made in permanent ink. Corrections were made by placing a single line through the original entry accompanied by the initials of the person entering the correction. At a minimum, information in the field notebook included:

- Date and atmospheric conditions
- Major activities to be performed
- Names of sampling personnel present (including subcontractors)
- Time of arrival at site, set-up, sample collection, and completion at each sample station
- General condition of sampling area

- Soil descriptions (except where recorded on boring logs)
- Start and stop times of work by others
- Any unusual events or occurrences.

In addition to maintaining the field notebook, a photographic record was maintained of the sampling activities. All photos taken were recorded in the field notebook.

Disposal of Investigation-Derived Waste

All wastes generated during this investigation were disposed of according to regulatory requirements.

Disposal of Incidental Trash

Incidental trash generated during this investigation (including discarded gloves, used Ziploc bags, paper towels, disposable bailers, packaging for well construction materials, and food packaging) was placed in plastic trash bags and disposed of as solid waste into a dumpster at Cascade Drilling Inc. facility in Woodinville, Washington.

Disposal of Soil Cuttings

Soil cuttings generated during drilling of soil borings were contained in 55-gallon drums stored temporarily onsite along the fence along the western property boundary near monitoring well FC-1. Arrangements will be made to dispose of contaminated soil at an approved treatment and disposal facility.

Decontamination Fluids and Purge Water Disposal

Decontamination fluids and purge water generated during sampling activities were secured in 55-gallon drums and temporarily stored along with the other drums along the fence along the western property boundary near monitoring well FC-1. Based on approval from King County Industrial Waste division, the water was discharged into a sink located inside Building 12.01. Emptied water drums were then taken to Northwest Cooperage to be recycled.

APPENDIX B

Boring Logs and Well Construction Details



SOIL BORING RECORD

Boring # GP-1
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999 GP1-5	drive push probe	100		4	SP	Brownish gray medium-grained SAND
				5		
>9999	drive push probe	100		6	SP	Grayish black medium-grained SAND, hydrocarbon-like odor noted
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-2
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
0.0	drive push probe	100		4	SP/ SP-SM	Grayish black SAND with some silt
				5		
0.0	drive push probe	100		6	SP/ML	Grayish black SAND with some silt lenses
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-3
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
0.0	drive push probe	100		4	SP/SP-SM	Grayish black SAND with some silt
				5		
0.0	drive push probe	100		6	SP/ML	Grayish black SAND with some silt lenses
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		Collected ground water sample GP3-W1 for chemical analysis
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-4
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SP	Dark brown medium-grained SAND
				5		
>9999	drive push probe	100		6	SP	Dark brown to black SAND, hydrocarbon-like odor noted
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		Collected ground water sample GP4-W1 for chemical analysis
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-5
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SP	Black medium-grained SAND; strong hydrocarbon-like odor noted
				5		
>9999	drive push probe	100		6	SP ∇	Black medium-grained SAND, at 6 feet free yellowish product layer noted on the water surface; ground water encountered at 6.0 feet
				7		
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-6
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SM	Gray silty SAND with gravel at 4 feet; hydrocarbon-like odor noted
				5		
>9999	drive push probe	100		6	SP	Black medium-grained SAND, strong hydrocarbon-like odor noted
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-7
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SP	Black SAND
GP7-5				5		
>9999	drive push probe	30		6	SP	Same as above
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-8
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999 GP8-5	drive push probe	100		4	SP	Black SAND
				5		
>9999	drive push probe	100		6	SP	Same as above; hydrocarbon-like odor noted
				7	<u>V</u>	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-9
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SP	Black SAND
				5		
0.0	drive push probe	100		6	SP	Same as above
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		Collected ground water sample GP9-W1 for chemical analysis
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-10
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SP	Black medium-grained SAND with white clayey silt lense
GP10-5				5		
>9999	drive push probe	100		6	SP	Black medium-grained SAND; slight hydrocarbon-like odor noted
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		Collected ground water sample GP10-W1 for chemical analysis
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-11
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SP	Black medium-grained SAND; slight hydrocarbon-like odor
				5		
>9999	drive push probe	100		6	SP	Black medium-grained SAND; slight hydrocarbon-like odor
				7	∇	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		Collected ground water sample GP11-W1 and duplicate sample GP16-W1 for chemical analysis
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-12
 Total depth 9 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
	drive push probe	100		2	GP	Pea-sized GRAVEL with some sand
				3		
	drive push probe	20		4	GP	Pea-sized GRAVEL
				5		
	drive push probe	30		6	GP	Pea-sized GRAVEL; strong hydrocarbon-like odor noted
				7		
GP12-7	drive push probe	100		8	∇	Ground water encountered during drilling at 7.5 feet
				9	SP	Black SAND; hydrocarbon-like odor noted
				10		Boring drilled and sampled to 9 feet; backfilled with bentonite chips.
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-13
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		Fill/wood waste
4500	drive push probe	100		4	SP	Black SAND
GP13-5				5		
	drive push probe	100		6	SP	Same as above
>9999	drive push probe			6	∇	Ground water encountered during drilling at 6.5 feet
				7		
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-14
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	100		4	SP	Black SAND with silt and occasional gravel
GP14-5				5		
>9999	drive push probe	100		6	SP	Brownish black SAND
				7	∇	Ground water encountered during drilling at 7.0 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



SOIL BORING RECORD

Boring # GP-15
 Total depth 7 feet
 Sheet 1 of 1

Project name FEDCEN Drilling Contractor Cascade Drilling Drilling method Drive push probe
 Project number C491.30 Location Federal Center South, Seattle Sampling method 2-foot long probe
 Client U.S. GSA Start date 8-11-98 Ground elevation NA
 HEC rep. Bruce Carpenter Compl. date 8-11-98 Air monitoring (Y/N) yes
 Instrument(s) Microtip 2020 PID

Instrument reading (ppm)	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description
				1		
				2		
				3		
>9999	drive push probe	30		4	SP	Brownish black medium-grained SAND with occasional gravel
				5		
>9999	drive push probe	100		6	SP	Black medium-grained SAND
				7	▽	Ground water encountered during drilling at 6.5 feet
				8		Boring drilled and sampled to 7 feet; backfilled with bentonite chips.
				9		Collected ground water sample GP15-W1 for chemical analysis
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		



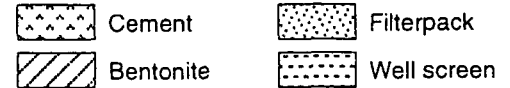
SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-1
Total depth: 16.5 feet
Sheet 1 of 2

Project name: <u>FEDCEN</u>	Drilling Contractor: <u>Cascade Drilling</u>	Casing material: <u>Sch. 40 PVC</u>
Project number: <u>C491.30</u>	Drilling method: <u>Hollow-stem auger</u>	Casing diameter: <u>2-inch</u>
Client: <u>U.S. GSA</u>	Sampling method: <u>Split spoon</u>	Screen slot width: <u>0.010-inch</u>
Location: <u>NW corner paved yard at</u>	Measuring point elev.: <u>99.23 feet</u>	Casing joint type: <u>Flush threaded</u>
<u>Federal Center South, Seattle, WA</u>	Ground elevation: <u>NA</u>	Filter pack: <u>Lonestar #2/12 silica sand</u>
HEC rep.: <u>Bruce Carpenter</u>	Air monitoring (y/n): <u>Yes</u>	Annular seal: <u>Bentonite chips</u>
Start Date: <u>6-30-99</u>	Instrument(s): <u>Microtip 2020 PID</u>	Monument type: <u>Flush-mounted</u>
Compl. Date: <u>6-30-99</u>		

Depth to water	@ 9 feet	5.11 feet	
Reference point	ground surface	top of casing	
Time	08:30	07:59	
Date	6/30/99	7/6/99	

Monitoring well details



Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				1	GP	Asphalt paving	
				1	GP	Crushed base coarse gravel	
	Hand auger			2	SP	Grayish brown, coarse-grained SAND with fine-grained gravel, moist (Fill)	
				3			
				4			
				5	SP	Medium dense, grayish brown, medium- to coarse-grained SAND with fine-grained gravel, moist (Fill)	
0.0	SPT	5	10	6			
			12				
			12				
				7			
				8			
				9	▽	Ground water encountered during drilling at 9 feet	
				10			
5.5	SPT	100	2	11	ML	Medium stiff, gray silt with some clay, organic material, wood debris, wet	
			3				
			5				
				12			
				13			
				14			



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-1
Total depth: 16.5 feet
Sheet 2 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: NW corner paved yard at
Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-Stem Auger
Sampling method: Split spoon
Measuring point elev.: 99.23 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 Silica Sand
Annular seal: Bentonite Chips
Monument type: Flush-mounted

Depth to water	@ 9 feet	5.11 feet	
Reference point	ground surface	top of casing	
Time	08:30	07:59	
Date	6/30/99	7/6/99	

Monitoring well details

	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				14			
4.4	SS	50	3	15	ML	Medium stiff, gray SILT with some clay, wet	
			4	16			
			4	17		Boring drilled to 15 feet; sampled to 16.5 feet; monitoring well installed.	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-2
Total depth: 16.5 feet
Sheet 1 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Between Northbay & fence at
Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-stem auger
Sampling method: Split spoon
Measuring point elev.: 100.59 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch. 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 silica sand
Annular seal: Bentonite chips
Monument type: Flush-mounted

Depth to water	@ 14 feet	5.90 feet	
Reference point	ground surface	top of casing	
Time	09:30	08:20	
Date	6/30/99	7/6/99	

Monitoring well details

	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				1	GP	Asphalt paving Crushed base coarse gravel	
	Hand auger			2	SP	Brown medium- to coarse-grained SAND with gravel	
				3			
				4			
7.1	SPT	60	7	5	SP	Medium dense, grayish black, medium- to coarse-grained SAND, moist	
			10	6			
			11				
				7			
				8			
				9			
4.8	SPT	100	3	10	ML	Stiff, grayish brown SILT with clay, organic material, wood debris, damp	
			4	11			
			5				
				12			
				13			
				14	▽	Ground water encountered during drilling at 14 feet	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-2
Total depth: 16.5 feet
Sheet 2 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Between Northbay & fence at
Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-Stem Auger
Sampling method: Split spoon
Measuring point elev.: 100.59 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 Silica Sand
Annular seal: Bentonite Chips
Monument type: Flush-mounted

Depth to water	@ 14 feet	5.90 feet	
Reference point	ground surface	top of casing	
Time	09:30	08:20	
Date	6/30/99	7/6/99	

Monitoring well details



Cement



Filterpack



Bentonite



Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				14			
8.8	SS	50	5	15	ML	Stiff, gray SILT with some clay and sand, wet	
			6	16			
			5	17		Boring drilled to 15 feet; sampled to 16.5 feet.; monitoring well installed.	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-3
Total depth: 16.5 feet
Sheet 1 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Between fence & truck bay #3
at Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-stem auger
Sampling method: Split spoon
Measuring point elev.: 100.73 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch. 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 silica sand
Annular seal: Bentonite chips
Monument type: Flush-mounted

Depth to water	@ 12 feet	6.09 feet	
Reference point	ground surface	top of casing	
Time	10:15	08:31	
Date	6/30/99	7/6/99	

Monitoring well details

	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
	Hand auger			1	GP	Asphalt paving Crushed base coarse gravel	
				2	SP	Brown medium- to coarse-grained SAND with gravel	
				3			
				4			
7.2	SPT	50	15	5	SP	Medium dense, grayish black, medium- to coarse-grained SAND, moist	
			15	6			
			15				
				7			
				8			
				9			
14.5	SPT	60	7	10	ML	Stiff, brown SILT with clay, organic material, wood debris, moist. Grades into grayish brown SILT with clay and trace amounts of sand, moist	
			8	11			
			7				
				12	▽	Ground water encountered during drilling at 12 feet	
				13			
				14			



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-3
Total depth: 16.5 feet
Sheet 2 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Between fence & truck bay #3
at Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-Stem Auger
Sampling method: Split spoon
Measuring point elev.: 100.73 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 Silica Sand
Annular seal: Bentonite Chips
Monument type: Flush-mounted

Depth to water	@ 12 feet	6.09 feet	
Reference point	ground surface	top of casing	
Time	10:15	08:31	
Date	6/30/99	7/6/99	

Monitoring well details



Cement



Filterpack



Bentonite



Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				14			
8.5	SS		6	15	ML	Stiff, gray SILT with clay and sand, wet	
			7	16			
			9				
				17		Boring drilled to 15 feet; sampled to 16.5 feet; monitoring well installed.	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-4
Total depth: 16.5 feet
Sheet 1 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Fence west of southend of
Bldg 12.03 at Federal Center South
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-stem auger
Sampling method: Split spoon
Measuring point elev.: 98.65 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch. 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 silica sand
Annular seal: Bentonite chips
Monument type: Flush-mounted

Depth to water	@ 14 feet	6.05 feet	
Reference point	ground surface	top of casing	
Time	12:45	08:41	
Date	6/30/99	7/6/99	

Monitoring well details

	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				1	GP	Asphalt paving Crushed base coarse gravel	
	Hand auger			2	SP	Brown medium- to coarse-grained SAND with gravel	
				3			
				4			
0.0	SPT	60	24	5	SP	Dense, brown coarse-grained SAND, grading to gray coarse-grained SAND with occasional gravel, moist	
			15	6			
			19				
				7			
				8			
				9			
				10			
	SPT	0	7	11		No recovery	
			6				
			7				
				12			
				13			
				14	▽	Ground water encountered during drilling at 14 feet	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-4
Total depth: 16.5 feet
Sheet 2 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Fence west of southend of
Bldg. 12.03 at Federal Center South
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-Stem Auger
Sampling method: Split spoon
Measuring point elev.: 98.65 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 Silica Sand
Annular seal: Bentonite Chips
Monument type: Flush-mounted

Depth to water	@ 14 feet	6.05 feet	
Reference point	ground surface	top of casing	
Time	12:45	08:41	
Date	6/30/99	7/6/99	

Monitoring well details			
	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				14			
			4	15			
0.0	SPT	100	5	16	ML	Stiff, gray SILT with some clay, occasional lense of silty fine-grained sand, wet	
			4				
				17		Boring drilled to 15 feet; sampled to 16.5 feet; monitoring well installed.	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-5
Total depth: 16.5 feet
Sheet 1 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: @ 23' west of SW corner of
Bldg 12.03 at Federal Center South
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-stem auger
Sampling method: Split spoon
Measuring point elev.: 100.29 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch. 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 silica sand
Annular seal: Bentonite chips
Monument type: Flush-mounted

Depth to water	@ 14 feet	5.48 feet	
Reference point	ground surface	top of casing	
Time	13:20	08:51	
Date	6/30/99	7/6/99	

Monitoring well details

	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				1	GP	Asphalt paving Crushed base coarse gravel	
	Hand auger			2	SP	Brown coarse-grained SAND with gravel	
				3			
				4			
				5	SP	Medium dense, black medium-grained SAND, wet	
0.0	SPT	90	12	6			
			12				
			11				
				7			
				8			
				9			
				10	ML	Stiff brown SILT with clay, wood debris, grades into gray SILT, moist	
0.0	SPT	100	4	11			
			4				
			4				
				12			
				13			
				14	▽	Ground water encountered during drilling at 14 feet	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-5
 Total depth: 16.5 feet
 Sheet 2 of 2

Project name: FEDCEN
 Project number: C491.30
 Client: U.S. GSA
 Location: @23' west of SW corner of
Bldg. 12.03 at Federal Center South
 HEC rep.: Bruce Carpenter
 Start Date: 6-30-99
 Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
 Drilling method: Hollow-Stem Auger
 Sampling method: Split spoon
 Measuring point elev.: 100.29 feet
 Ground elevation: NA
 Air monitoring (y/n): Yes
 Instrument(s): Microtip 2020 PID

Casing material: Sch 40 PVC
 Casing diameter: 2-inch
 Screen slot width: 0.010-inch
 Casing joint type: Flush threaded
 Filter pack: Lonestar #2/12 Silica Sand
 Annular seal: Bentonite Chips
 Monument type: Flush-mounted

Depth to water	@ 14 feet	5.48 feet	
Reference point	ground surface	top of casing	
Time	13:20	08:51	
Date	6/30/99	7/6/99	

Monitoring well details			
	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				14			
			5	15			
0.0	SPT		5	16	ML	Stiff, gray SILT with some clay, occasional lense of silty fine-grained sand, wet	
			5	17		Boring drilled to 15 feet; sampled to 16.5 feet; monitoring well installed.	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-6
Total depth: 16.5 feet
Sheet 1 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Area of former fuel dispenser at
Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-stem auger
Sampling method: Split spoon
Measuring point elev.: 99.76 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch. 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 silica sand
Annular seal: Bentonite chips
Monument type: Flush-mounted

Depth to water	@ 10 feet	4.96 feet	
Reference point	ground surface	top of casing	
Time	14:30	09:12	
Date	6/30/99	7/6/99	

Monitoring well details

	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
	Hand auger			1	GP	Asphalt paving	
				2		Crushed gravel (Fill)	
				3			
				4			
				5			
21	SPT	40	7	6	SP	Medium dense, black medium-grained SAND, wet; hydrocarbon-like odor noted	
			10				
			8				
				7			
				8			
				9			
				10	▽	Ground water encountered during drilling at 10 feet	
0.0	SPT	100	2	11	ML	Medium stiff brown SILT with clay, organic material, wood debris, grades to gray SILT with clay, moist to wet	
			3				
			4				
				12			
				13			
				14			



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-6
Total depth: 16.5 feet
Sheet 2 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: Area of former fuel dispenser at
Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-Stem Auger
Sampling method: Split spoon
Measuring point elev.: 99.76 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 Silica Sand
Annular seal: Bentonite Chips
Monument type: Flush-mounted

Depth to water	@ 10 feet	4.96 feet	
Reference point	ground surface	top of casing	
Time	14:30	09:12	
Date	6/30/99	7/6/99	

Monitoring well details



Cement



Filterpack



Bentonite



Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				14			
0.0	SPT	60	1	15	ML	Soft gray SILT with clay and sand lenses, wet	
			1	16			
			1	17		Boring drilled to 15 feet; sampled to 16.5 feet; monitoring well installed.	



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-7
Total depth: 16.5 feet
Sheet 1 of 2

Project name: <u>FEDCEN</u>	Drilling Contractor: <u>Cascade Drilling</u>	Casing material: <u>Sch. 40 PVC</u>
Project number: <u>C491.30</u>	Drilling method: <u>Hollow-stem auger</u>	Casing diameter: <u>2-inch</u>
Client: <u>U.S. GSA</u>	Sampling method: <u>Split spoon</u>	Screen slot width: <u>0.010-inch</u>
Location: <u>@ 15 feet west of GP-2 at</u>	Measuring point elev.: <u>100.00 feet</u>	Casing joint type: <u>Flush threaded</u>
<u>Federal Center South, Seattle, WA</u>	Ground elevation: <u>NA</u>	Filter pack: <u>Lonestar #2/12 silica sand</u>
HEC rep.: <u>Bruce Carpenter</u>	Air monitoring (y/n): <u>Yes</u>	Annular seal: <u>Bentonite chips</u>
Start Date: <u>6-30-99</u>	Instrument(s): <u>Microtip 2020 PID</u>	Monument type: <u>Flush-mounted</u>
Compl. Date: <u>6-30-99</u>		

Depth to water	@ 13 feet	5.18 feet	
Reference point	ground surface	top of casing	
Time	07:30	09:02	
Date	7/01/99	7/6/99	

Monitoring well details



Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				1	GP	Asphalt paving Crushed base-coarse gravel	
	Hand auger			2	SP	Brown medium-grained SAND	
				3			
				4			
0.0	SPT	50	10	5	SP	Dense, black medium-grained SAND, wet	
			15	6			
			17				
				7			
				8			
				9			
0.0	SPT	100	4	10	ML	Stiff brown SILT with clay, organic material, wood debris, grades to black medium-grained SAND, grades to SILT, wet	
			5	11	SP		
			7		ML		
				12			
				13	▽	Ground water encountered during drilling at 13 feet	
				14			



SOIL BORING AND MONITORING WELL CONSTRUCTION RECORD

Boring # FC-7
Total depth: 16.5 feet
Sheet 2 of 2

Project name: FEDCEN
Project number: C491.30
Client: U.S. GSA
Location: @ 15 feet west pf GP-2 at
Federal Center South, Seattle, WA
HEC rep.: Bruce Carpenter
Start Date: 6-30-99
Compl. Date: 6-30-99

Drilling Contractor: Cascade Drilling
Drilling method: Hollow-Stem Auger
Sampling method: Split spoon
Measuring point elev.: 100.00 feet
Ground elevation: NA
Air monitoring (y/n): Yes
Instrument(s): Microtip 2020 PID

Casing material: Sch 40 PVC
Casing diameter: 2-inch
Screen slot width: 0.010-inch
Casing joint type: Flush threaded
Filter pack: Lonestar #2/12 Silica Sand
Annular seal: Bentonite Chips
Monument type: Flush-mounted

Depth to water	@ 13 feet	5.18 feet	
Reference point	ground surface	top of casing	
Time	07:30	09:02	
Date	7/01/99	7/6/99	

Monitoring well details			
	Cement		Filterpack
	Bentonite		Well screen

Instrument reading	Sample type, interval	% recovery	Blow counts	Depth (feet, BGS)	Soil group	Soil description Include: group name, group symbol, color, moisture content, consistency, compaction, plasticity, miscellaneous (odor, coating, etc.)	Well details
				14			
			4	15			
0.0	SPT	60	4	16	ML	Stiff, gray SILT with clay and some sand, wet	
			5	17			
						Boring drilled to 15 feet; sampled to 16.5 feet; monitoring well installed.	

APPENDIX C

Initial Site Investigation Laboratory Analytical Certificates— OnSite Environmental Inc.



**OnSite
Environmental Inc.**

Analytical Testing and Mobile Laboratory Services

August 20, 1998

Peter Jowise
Herrera Environmental Consultants, Inc.
2200 6th Avenue, Suite 601
Seattle, WA 98121

Re: Analytical Data for Project C491.30
Laboratory Reference No. 9808-059

Dear Peter:

Enclosed are the analytical results and associated quality control data for samples submitted on August 12, 1998.

The standard policy of OnSite Environmental Inc., is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Chemist

Enclosures

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-G/BTEX

Date Extracted: 8-13-98
Date Analyzed: 8-14-98

Matrix: Soil
Units: mg/Kg (ppm)

Client ID: **GP1-5**
Lab ID: 08-059-01

GP7-5
08-059-02

	Result	Flags	PQL	Result	Flags	PQL
Benzene	ND		0.060	ND		0.057
Toluene	ND		0.060	ND		0.057
Ethyl Benzene	ND		0.060	ND		0.057
m,p-Xylene	ND		0.060	ND		0.057
o-Xylene	ND		0.060	ND		0.057
TPH-Gas	ND		6.0	ND	R	5.7
Surrogate Recovery:						
Fluorobenzene	94%			105%		

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-G/BTEX

Date Extracted: 8-13-98
Date Analyzed: 8-14-98

Matrix: Soil
Units: mg/Kg (ppm)

Client ID: **GP8-5**
Lab ID: 08-059-03

GP10-5
08-059-04

	Result	Flags	PQL	Result	Flags	PQL
Benzene	ND		0.32	ND		0.063
Toluene	ND		0.32	ND		0.063
Ethyl Benzene	ND		0.32	ND		0.063
m,p-Xylene	ND		0.32	ND		0.063
o-Xylene	ND		0.32	ND		0.063
TPH-Gas	ND	R	32	ND		6.3
Surrogate Recovery:						
Fluorobenzene	69%			91%		

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
METHOD BLANK QUALITY CONTROL**

Date Extracted: 8-13-98

Date Analyzed: 8-13-98

Matrix: Soil

Units: mg/Kg (ppm)

Lab ID: MB0813S1

	Result	Flags	PQL
Benzene	ND		0.050
Toluene	ND		0.050
Ethyl Benzene	ND		0.050
m,p-Xylene	ND		0.050
o-Xylene	ND		0.050
TPH-Gas	ND		5.0
Surrogate Recovery: Fluorobenzene	119%		

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
DUPLICATE QUALITY CONTROL**

Date Extracted: 8-13-98
Date Analyzed: 8-14-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID:	08-070-09 Original	08-070-09 Duplicate	RPD	Flags
Benzene	ND	ND	NA	
Toluene	ND	ND	NA	
Ethyl Benzene	ND	ND	NA	
m,p-Xylene	ND	ND	NA	
o-Xylene	ND	ND	NA	
TPH-Gas	ND	ND	NA	
Surrogate Recovery:				
Fluorobenzene	102%	106%		

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
MS/MSD QUALITY CONTROL**

Date Extracted: 8-12-98
Date Analyzed: 8-13-98

Matrix: Soil
Units: mg/Kg (ppm)

Spike Level: 1.00 ppm

Lab ID:	08-056-01 MS	Percent Recovery	08-056-01 MSD	Percent Recovery	RPD
Benzene	0.838	84	0.824	82	1.7
Toluene	0.893	89	0.879	88	1.6
Ethyl Benzene	0.906	91	0.892	89	1.6
m,p-Xylene	0.905	90	0.893	89	1.3
o-Xylene	0.934	93	0.918	92	1.7
Surrogate Recovery:					
Fluorobenzene	94%		93%		

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-G/BTEX

Date Extracted: 8-13-98
Date Analyzed: 8-13-98

Matrix: Water
Units: ug/L (ppb)

Client ID: GP3-W1
Lab ID: 08-059-08

	Result	Flags	PQL
Benzene	ND		1.0
Toluene	ND		1.0
Ethyl Benzene	ND		1.0
m,p-Xylene	ND		1.0
o-Xylene	ND		1.0
TPH-Gas	ND		100
Surrogate Recovery:			
Fluorobenzene	84%		

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
METHOD BLANK QUALITY CONTROL**

Date Extracted: 8-13-98
Date Analyzed: 8-13-98

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0813W1

	Result	Flags	PQL
Benzene	ND		1.0
Toluene	ND		1.0
Ethyl Benzene	ND		1.0
m,p-Xylene	ND		1.0
o-Xylene	ND		1.0
TPH-Gas	ND		100

Surrogate Recovery:
Fluorobenzene 82%

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
DUPLICATE QUALITY CONTROL**

Date Extracted: 8-12-98
Date Analyzed: 8-12-98

Matrix: Water
Units: ug/L (ppb)

Lab ID:	08-054-01 Original	08-054-01 Duplicate	RPD	Flags
Benzene	ND	ND	NA	
Toluene	ND	ND	NA	
Ethyl Benzene	ND	ND	NA	
m,p-Xylene	ND	ND	NA	
o-Xylene	ND	ND	NA	
TPH-Gas	ND	ND	NA	
Surrogate Recovery:				
Fluorobenzene	89%	88%		

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
MS/MSD QUALITY CONTROL**

Date Extracted: 8-12-98
Date Analyzed: 8-12-98

Matrix: Water
Units: ug/L (ppb)
Spike Level: 50.0 ppb

Lab ID:	08-054-01 MS	Percent Recovery	08-054-01 MSD	Percent Recovery	RPD
Benzene	49.5	99	48.9	98	1.1
Toluene	51.6	103	51.1	102	0.99
Ethyl Benzene	52.0	104	51.6	103	0.79
m,p-Xylene	51.9	104	51.5	103	0.75
o-Xylene	53.8	108	53.4	107	0.86

Surrogate Recovery:

Fluorobenzene	84%	90%
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Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx

Date Extracted: 8-13-98
Date Analyzed: 8-13-98

Matrix: Soil
Units: mg/Kg (ppm)

Client ID:	GP12-7	GP13-5	GP14-5
Lab ID:	08-059-05	08-059-06	08-059-07
Diesel Fuel:	ND	ND	ND
PQL:	32	32	31
Heavy Oil:	130	ND	ND
PQL:	64	63	63
Surrogate Recovery:			
o-Terphenyl	66%	80%	77%

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx
METHOD BLANK QUALITY CONTROL

Date Extracted: 8-13-98
Date Analyzed: 8-13-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: MB0813S1

Diesel Fuel: ND
PQL: 25

Heavy Oil: ND
PQL: 50

Surrogate Recovery:
o-Terphenyl 63%

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx
DUPLICATE QUALITY CONTROL

Date Extracted: 8-12-98
Date Analyzed: 8-12-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 08-058-07 08-058-07 DUP

Diesel Fuel: ND ND
PQL: 25 25

RPD: N/A

Surrogate Recovery:
o-Terphenyl 68% 73%

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx
SB/SBD QUALITY CONTROL

Date Extracted: 8-13-98
Date Analyzed: 8-18-98

Matrix: Soil
Units: mg/Kg (ppm)

Spike Level: 100 ppm

Lab ID: SB0813S1 SB0813S1 DUP

Diesel Fuel: 84.5 84.3

PQL: 25 25

Percent Recovery: 85 84

RPD: 0.24

Surrogate Recovery:
o-Terphenyl 90% 89%

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx

Date Extracted: 8-13-98
Date Analyzed: 8-13-98

Matrix: Water
Units: mg/L (ppm)

Client ID: GP15-W1
Lab ID: 08-059-13

Diesel Fuel: ND
PQL: 0.25

Heavy Oil: ND
PQL: 0.50

Surrogate Recovery:
o-Terphenyl 62%

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx
METHOD BLANK QUALITY CONTROL

Date Extracted: 8-13-98
Date Analyzed: 8-13-98

Matrix: Water
Units: mg/L (ppm)

Lab ID: MB0813W1

Diesel Fuel: ND
PQL: 0.25

Heavy Oil: ND
PQL: 0.50

Surrogate Recovery:
o-Terphenyl 66%

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-Dx
DUPLICATE QUALITY CONTROL**

Date Extracted: 8-12-98
Date Analyzed: 8-12-98

Matrix: Water
Units: mg/L (ppm)

Lab ID: 08-042-01 08-042-01 DUP

Diesel Fuel: ND ND
PQL: 0.25 0.25

RPD: N/A

Surrogate Recovery:
o-Terphenyl 113% 100%

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx
SB/SBD QUALITY CONTROL

Date Extracted: 8-12-98
Date Analyzed: 8-12-98

Matrix: Water
Units: mg/L (ppm)

Spike Level: 1.00 ppm

Lab ID: SB0812W1 SB0812W1 DUP

Diesel Fuel:	0.913	0.934
PQL:	0.25	0.25

Percent Recovery:	91	93
RPD:	2.3	

Surrogate Recovery:		
o-Terphenyl	95%	87%

Flags:

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

VOLATILES by EPA 8260B
 page 1 of 2

Date Extracted: 8-19-98
 Date Analyzed: 8-19-98

Matrix: Soil
 Units: mg/Kg (ppm)

Lab ID: 08-059-05
 Client ID: GP12-7

Compound	Results	Flags	PQL
Dichlorodifluoromethane	ND		0.064
Chloromethane	ND		0.064
Vinyl Chloride	ND		0.064
Bromomethane	ND		0.064
Chloroethane	ND		0.064
Trichlorofluoromethane	ND		0.064
1,1-Dichloroethene	ND		0.064
Methylene Chloride	0.28	B	0.064
(trans) 1,2-Dichloroethene	ND		0.064
1,1-Dichloroethane	ND		0.064
2,2-Dichloropropane	ND		0.064
(cis) 1,2-Dichloroethene	ND		0.064
Chloroform	ND		0.064
1,1,1-Trichloroethane	ND		0.064
Carbon Tetrachloride	ND		0.064
1,1-Dichloropropene	ND		0.064
Benzene	ND		0.064
1,2-Dichloroethane	ND		0.064
1,1-Dichloroethene	ND		0.064
1,2-Dichloropropane	ND		0.064
Dibromomethane	ND		0.064
Bromodichloromethane	ND		0.064
(cis) 1,3-Dichloropropene	ND		0.064
Toluene	ND		0.064
(trans) 1,3-Dichloropropene	ND		0.064
1,1,2-Trichloroethane	ND		0.064
Tetrachloroethene	ND		0.064
1,3-Dichloropropane	ND		0.064

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

VOLATILES by EPA 8260B
 page 2 of 2

Lab ID: 08-059-05
 Client ID: GP12-7

Compound	Results	Flags	PQL
Dibromochloromethane	ND		0.064
1,2-Dibromoethane	ND		0.32
Chlorobenzene	ND		0.064
1,1,1,2-Tetrachloroethane	ND		0.064
Ethylbenzene	ND		0.064
m,p-Xylene	ND		0.13
o-Xylene	ND		0.064
Styrene	ND		0.064
Bromoform	ND		0.064
Isopropylbenzene	ND		0.064
Bromobenzene	ND		0.064
1,1,2,2-Tetrachloroethane	ND		0.064
1,2,3-Trichloropropane	ND		0.064
n-Propylbenzene	ND		0.064
2-Chlorotoluene	ND		0.064
4-Chlorotoluene	ND		0.064
1,3,5-Trimethylbenzene	ND		0.064
tert-Butylbenzene	ND		0.064
1,2,4-Trimethylbenzene	ND		0.064
sec-Butylbenzene	ND		0.064
1,3-Dichlorobenzene	ND		0.064
p-Isopropyltoluene	ND		0.064
1,4-Dichlorobenzene	ND		0.064
1,2-Dichlorobenzene	ND		0.064
n-Butylbenzene	ND		0.064
1,2-Dibromo-3-chloropropane	ND		0.64
1,2,4-Trichlorobenzene	ND		0.064
Hexachlorobutadiene	ND		0.064
Naphthalene	ND		0.64
1,2,3-Trichlorobenzene	ND		0.064
Surrogate	Percent Recovery		
Dibromofluoromethane	114		
Toluene-d8	116		
4-Bromofluorobenzene	102		

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

VOLATILES by EPA 8260B
 page 1 of 2

Date Extracted: 8-19-98
 Date Analyzed: 8-19-98

 Matrix: Soil
 Units: mg/Kg (ppm)

 Lab ID: 08-059-07
 Client ID: GP14-5

Compound	Results	Flags	PQL
Dichlorodifluoromethane	ND		0.063
Chloromethane	ND		0.063
Vinyl Chloride	ND		0.063
Bromomethane	ND		0.063
Chloroethane	ND		0.063
Trichlorofluoromethane	ND		0.063
1,1-Dichloroethene	ND		0.063
Methylene Chloride	0.088	B	0.063
(trans) 1,2-Dichloroethene	ND		0.063
1,1-Dichloroethane	ND		0.063
2,2-Dichloropropane	ND		0.063
(cis) 1,2-Dichloroethene	ND		0.063
Chloroform	ND		0.063
1,1,1-Trichloroethane	ND		0.063
Carbon Tetrachloride	ND		0.63
1,1-Dichloropropene	ND		0.063
Benzene	ND		0.063
1,2-Dichloroethane	ND		0.063
Trichloroethene	ND		0.063
1,2-Dichloropropane	ND		0.063
Dibromomethane	ND		0.063
Bromodichloromethane	ND		0.063
(cis) 1,3-Dichloropropene	ND		0.063
Toluene	ND		0.063
(trans) 1,3-Dichloropropene	ND		0.063
1,1,2-Trichloroethane	ND		0.063
Tetrachloroethene	ND		0.063
1,3-Dichloropropane	ND		0.063

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

VOLATILES by EPA 8260B
 page 2 of 2

Lab ID: 08-059-07
 Client ID: GP14-5

Compound	Results	Flags	PQL
Dibromochloromethane	ND		0.063
1,2-Dibromoethane	ND		0.31
Chlorobenzene	ND		0.063
1,1,1,2-Tetrachloroethane	ND		0.063
Ethylbenzene	ND		0.063
m,p-Xylene	ND		0.13
o-Xylene	ND		0.063
Styrene	ND		0.063
Bromoform	ND		0.063
Isopropylbenzene	ND		0.063
Bromobenzene	ND		0.063
1,1,2,2-Tetrachloroethane	ND		0.063
1,2,3-Trichloropropane	ND		0.063
n-Propylbenzene	ND		0.063
2-Chlorotoluene	ND		0.063
4-Chlorotoluene	ND		0.063
1,3,5-Trimethylbenzene	ND		0.063
tert-Butylbenzene	ND		0.063
1,2,4-Trimethylbenzene	ND		0.063
sec-Butylbenzene	ND		0.063
1,3-Dichlorobenzene	ND		0.063
p-Isopropyltoluene	ND		0.063
1,4-Dichlorobenzene	ND		0.063
1,2-Dichlorobenzene	ND		0.063
n-Butylbenzene	ND		0.063
1,2-Dibromo-3-chloropropane	ND		0.63
1,2,4-Trichlorobenzene	ND		0.063
Hexachlorobutadiene	ND		0.063
Naphthalene	ND		0.63
1,2,3-Trichlorobenzene	ND		0.063

Surrogate	Percent Recovery
Dibromofluoromethane	107
Toluene-d8	110
4-Bromofluorobenzene	98

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

VOLATILES by EPA 8260B
METHOD BLANK QUALITY CONTROL
 page 1 of 2

Date Extracted: 8-19-98
 Date Analyzed: 8-19-98

 Matrix: Soil
 Units: mg/Kg (ppm)

 Lab ID: MB0819S1

Compound	Results	Flags	PQL
Dichlorodifluoromethane	ND		0.050
Chloromethane	ND		0.050
Vinyl Chloride	ND		0.050
Bromomethane	ND		0.050
Chloroethane	ND		0.050
Trichlorofluoromethane	ND		0.050
1,1-Dichloroethene	ND		0.050
Methylene Chloride	0.074		0.050
(trans) 1,2-Dichloroethene	ND		0.050
1,1-Dichloroethane	ND		0.050
2,2-Dichloropropane	ND		0.050
(cis) 1,2-Dichloroethene	ND		0.050
Chloroform	ND		0.050
1,1,1-Trichloroethane	ND		0.050
Carbon Tetrachloride	ND		0.50
1,1-Dichloropropene	ND		0.050
Benzene	ND		0.050
1,2-Dichloroethane	ND		0.050
Trichloroethene	ND		0.050
1,2-Dichloropropane	ND		0.050
Dibromomethane	ND		0.050
Bromodichloromethane	ND		0.050
(cis) 1,3-Dichloropropene	ND		0.050
Toluene	ND		0.050
(trans) 1,3-Dichloropropene	ND		0.050
1,1,2-Trichloroethane	ND		0.050
Tetrachloroethene	ND		0.050
1,3-Dichloropropane	ND		0.050

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

VOLATILES by EPA 8260B
METHOD BLANK QUALITY CONTROL
 page 2 of 2

Lab ID: MB0819S1

Compound	Results	Flags	PQL
Dibromochloromethane	ND		0.050
1,2-Dibromoethane	ND		0.25
Chlorobenzene	ND		0.050
1,1,1,2-Tetrachloroethane	ND		0.050
Ethylbenzene	ND		0.050
m,p-Xylene	ND		0.10
o-Xylene	ND		0.050
Styrene	ND		0.050
Bromoform	ND		0.050
Isopropylbenzene	ND		0.050
Bromobenzene	ND		0.050
1,1,2,2-Tetrachloroethane	ND		0.050
1,2,3-Trichloropropane	ND		0.050
n-Propylbenzene	ND		0.050
2-Chlorotoluene	ND		0.050
4-Chlorotoluene	ND		0.050
1,3,5-Trimethylbenzene	ND		0.050
tert-Butylbenzene	ND		0.050
1,2,4-Trimethylbenzene	ND		0.050
sec-Butylbenzene	ND		0.050
1,3-Dichlorobenzene	ND		0.050
p-Isopropyltoluene	ND		0.050
1,4-Dichlorobenzene	ND		0.050
1,2-Dichlorobenzene	ND		0.050
n-Butylbenzene	ND		0.050
1,2-Dibromo-3-chloropropane	ND		0.50
1,2,4-Trichlorobenzene	ND		0.050
Hexachlorobutadiene	ND		0.050
Naphthalene	ND		0.50
1,2,3-Trichlorobenzene	ND		0.050

Surrogate	Percent Recovery
Dibromofluoromethane	137
Toluene-d8	133
4-Bromofluorobenzene	117

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**VOLATILES by EPA 8260B
MS/MSD QUALITY CONTROL**

Date Extracted: 8-19-98
Date Analyzed: 8-19-98

Matrix: Soil
Units: mg/Kg (ppm)

Dilution Factor: 50

Lab ID: 08-059-07

Compound	Spike Amount	MS	Percent Recovery	MSD	Percent Recovery	RPD
1,1-Dichloroethene	2.50	2.00	80	2.29	91	13
Benzene	2.50	2.55	102	2.70	108	5.5
Trichloroethene	2.50	2.20	88	2.24	89	1.6
Toluene	2.50	2.43	97	2.50	100	2.6
Chlorobenzene	2.50	2.26	90	2.30	92	2.0

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

PAH's by EPA 8270C

Date Extracted: 8-14-98
 Date Analyzed: 8-18-98

Matrix: Soil
 Units: mg/kg (ppm)

Lab ID: 08-059-05
 Client ID: GP12-7

Compound:	Results	Flags	PQL
Naphthalene	ND		0.043
2-Methylnaphthalene	ND		0.043
Acenaphthylene	ND		0.043
Acenaphthene	ND		0.043
Fluorene	ND		0.043
Phenanthrene	ND		0.043
Anthracene	ND		0.043
Fluoranthene	ND		0.043
Pyrene	ND		0.043
Benzo[a]anthracene	ND		0.043
Chrysene	ND		0.043
Benzo[b]fluoranthene	ND		0.043
Benzo[k]fluoranthene	ND		0.043
Benzo[a]pyrene	ND		0.043
Indeno[1,2,3-cd]pyrene	ND		0.043
Dibenz[a,h]anthracene	ND		0.043
Benzo[g,h,i]perylene	ND		0.043

Surrogate :	Percent Recovery	Flags	Control Limits
Nitrobenzene-d5	76		23 - 120
2-Fluorobiphenyl	64		30 - 115
Terphenyl-d14	102		18 - 137

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

PAH's by EPA 8270C

Date Extracted: 8-14-98
 Date Analyzed: 8-18-98

 Matrix: Soil
 Units: mg/kg
 (ppm)

 Lab ID: 08-059-07
 Client ID: GP14-5

Compound:	Results	Flags	PQL
Naphthalene	ND		0.042
2-Methylnaphthalene	ND		0.042
Acenaphthylene	ND		0.042
Acenaphthene	ND		0.042
Fluorene	ND		0.042
Phenanthrene	ND		0.042
Anthracene	ND		0.042
Fluoranthene	ND		0.042
Pyrene	ND		0.042
Benzo[a]anthracene	ND		0.042
Chrysene	ND		0.042
Benzo[b]fluoranthene	ND		0.042
Benzo[k]fluoranthene	ND		0.042
Benzo[a]pyrene	ND		0.042
Indeno[1,2,3-cd]pyrene	ND		0.042
Dibenz[a,h]anthracene	ND		0.042
Benzo[g,h,i]perylene	ND		0.042

Surrogate :	Percent Recovery	Flags	Control Limits
Nitrobenzene-d5	47		23 - 120
2-Fluorobiphenyl	37		30 - 115
Terphenyl-d14	139	*	18 - 137

*. Surrogate recovery outside control limit

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

**PAH's by EPA 8270C
 METHOD BLANK QUALITY CONTROL**

Date Extracted: 8-14-98
 Date Analyzed: 8-18-98

 Matrix: Soil
 Units: mg/kg (ppm)

 Lab ID: MB0814S1

Compound:	Results	Flags	PQL
Naphthalene	ND		0.033
2-Methylnaphthalene	ND		0.033
Acenaphthylene	ND		0.033
Acenaphthene	ND		0.033
Fluorene	ND		0.033
Phenanthrene	ND		0.033
Anthracene	ND		0.033
Fluoranthene	ND		0.033
Pyrene	ND		0.033
Benzo[a]anthracene	ND		0.033
Chrysene	ND		0.033
Benzo[b]fluoranthene	ND		0.033
Benzo[k]fluoranthene	ND		0.033
Benzo[a]pyrene	ND		0.033
Indeno[1,2,3-cd]pyrene	ND		0.033
Dibenz[a,h]anthracene	ND		0.033
Benzo[g,h,i]perylene	ND		0.033

Surrogate :	Percent Recovery	Flags	Control Limits
Nitrobenzene-d5	73		23 - 120
2-Fluorobiphenyl	54		30 - 115
Terphenyl-d14	124		18 - 137

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

**PAH's by EPA 8270C
 MS/MSD QUALITY CONTROL**

Date Extracted: 8-14-98
 Date Analyzed: 8-18-98

Matrix: Soil
 Units: mg/kg(ppm)

Lab ID: 08-059-05

Compound:	Spike Amount	MS	Percent Recovery	MSD	Percent Recovery	RPD
Phenol	3.30	2.81	85	2.51	76	11
2-Chlorophenol	3.30	1.83	56	1.60	49	13
1,4-Dichlorobenzene	1.65	0.790	48	0.690	42	15
N-Nitroso-di-n-propylamine	1.65	1.25	76	1.10	67	12
1,2,4-Trichlorobenzene	1.65	0.810	49	0.730	44	10
4-Chloro-3-methylphenol	3.30	3.02	92	2.69	81	12
Acenaphthene	1.65	1.45	88	1.25	76	14
2,4-Dinitrotoluene	1.65	1.27	77	1.01	61	22
4-Nitrophenol	3.30	2.86	87	2.55	77	11
Pentachlorophenol	3.30	2.84	86	2.76	84	2.8
Pyrene	1.65	1.84	112	1.82	110	1.5

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

PCB's by EPA 8082

Date Extracted: 8-14-98
Date Analyzed: 8-17-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 08-059-05
Client ID: GP12-7

	Result	PQL
Aroclor 1016:	ND	0.064
Aroclor 1221:	ND	0.064
Aroclor 1232:	ND	0.064
Aroclor 1242:	ND	0.064
Aroclor 1248:	ND	0.064
Aroclor 1254:	ND	0.064
Aroclor 1260:	ND	0.064

	Percent Recovery	Control Limits
Surrogate Decachlorobiphenyl	78	48-148

Flags:

Date of Report: August 20, 1998
 Samples Submitted: August 12, 1998
 Lab Traveler: 08-059
 Project: C491.30

PCB's by EPA 8082

Date Extracted: 8-14-98
 Date Analyzed: 8-17-98
 Matrix: Soil
 Units: mg/Kg (ppm)

Lab ID: 08-059-07
 Client ID: GP14-5

	Result	PQL
Aroclor 1016:	ND	0.063
Aroclor 1221:	ND	0.063
Aroclor 1232:	ND	0.063
Aroclor 1242:	ND	0.063
Aroclor 1248:	ND	0.063
Aroclor 1254:	ND	0.063
Aroclor 1260:	ND	0.063

Surrogate	Percent Recovery	Control Limits
Decachlorobiphenyl	83	48 - 148

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**PCB's by EPA 8082
METHOD BLANK QUALITY CONTROL**

Date Extracted: 8-14-98

Date Analyzed: 8-17-98

Matrix: Soil

Units: mg/Kg (ppm)

Lab ID: MB0814S1

	Result	PQL
Aroclor 1016:	ND	0.050
Aroclor 1221:	ND	0.050
Aroclor 1232:	ND	0.050
Aroclor 1242:	ND	0.050
Aroclor 1248:	ND	0.050
Aroclor 1254:	ND	0.050
Aroclor 1260:	ND	0.050

Surrogate	Percent Recovery	Control Limits
Decachlorobiphenyl	86	48 - 148

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**PCB's by EPA 8082
MS/MSD QUALITY CONTROL**

Date Extracted: 8-14-98
Date Analyzed: 8-17-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 08-061-01

Spike Level: 0.50

	MS Result	Percent Recovery	MSD Result	Percent Recovery	RPD
Aroclor 1260:	0.560	90	0.533	85	4.9
PQL	0.050		0.0500		

Surrogate	Percent Recovery	Percent Recovery	Control Limits
Decachlorobiphenyl	91	87	48 - 148

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**PCB's by EPA 8082
SPIKE BLANK QUALITY CONTROL**

Date Extracted: 8-14-98
Date Analyzed: 8-17-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: SB0814S1

Spike Level: 0.50

	Result	Percent Recovery
Aroclor 1260:	0.461	92

Surrogate	Percent Recovery	Control Limits
Decachlorobiphenyl	89	48 - 148

Flags:

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**TOTAL METALS
EPA 6010B**

Date Extracted: 8-14-98
Date Analyzed: 8-17-98

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: 08-059-05
Client ID: GP12-7

Analyte	Method	Result	PQL
Chromium	6010B	6.5	0.64
Zinc	6010B	23	1.3

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**TOTAL METALS
EPA 6010B**

Date Extracted: 8-14-98
Date Analyzed: 8-17-98

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: 08-059-07
Client ID: GP14-5

Analyte	Method	Result	PQL
Chromium	6010B	6.1	0.63
Zinc	6010B	12	1.3

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**TOTAL METALS
EPA 6010B
METHOD BLANK QUALITY CONTROL**

Date Extracted: 8-14-98
Date Analyzed: 8-17-98

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: MB0814S1

Analyte	Method	Result	PQL
Chromium	6010B	ND	0.50
Zinc	6010B	ND	1.0

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**TOTAL METALS
EPA 6010B
DUPLICATE QUALITY CONTROL**

Date Extracted: 8-14-98
Date Analyzed: 8-17-98

Matrix: Soil
Units: mg/kg (ppm)

Lab ID: 08-083-03

Analyte	Sample Result	Duplicate Result	RPD	Flags	PQL
Chromium	13.1	11.0	17		0.50
Zinc	20.6	19.3	6.5		1.0

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**TOTAL METALS
EPA 6010B
MS/MSD QUALITY CONTROL**

Date Extracted: 8-14-98

Date Analyzed: 8-17-98

Matrix: Soil

Units: mg/kg (ppm)

Lab ID: 08-083-03

Analyte	Spike Level	MS	Percent Recovery	MSD	Percent Recovery	RPD	Flags
Chromium	100	106	93	108	95	2.1	
Zinc	50	71.3	101	69.5	98	2.6	

Date of Report: August 20, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

Date Analyzed: 8-13-98

% MOISTURE

Client ID	Lab ID	% Moisture
GP1-5	08-059-01	17
GP7-5	08-059-02	13
GP8-5	08-059-03	22
GP10-5	08-059-04	21
GP12-7	08-059-05	22
GP13-5	08-059-06	21
GP14-5	08-059-07	20



**OnSite
Environmental Inc.**

DATA QUALIFIERS AND ABBREVIATIONS

- A - Due to high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.
- B - The analyte indicated was also found in the blank sample.
- C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.
- D - Data from 1:_____ dilution.
- E - The value reported exceeds the quantitation range, and is an estimate.
- F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.
- G - Insufficient sample quantity for duplicate analysis.
- J - The value reported was below the practical quantitation limit. The value is an estimate.
- K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.
- M - Predominantly _____ range hydrocarbons present in the sample.
- N - Hydrocarbons in the gasoline range (C7-toluene) are present in the sample which are elevating the diesel result.
- O - Hydrocarbons in the heavy oil range (>C24) are present in the sample which are elevating the diesel result.
- P - Hydrocarbons in the diesel range (C12-C24) are present in the sample which are elevating the oil result.
- Q - The RPD of the results between the two columns is greater than 25.
- R - Hydrocarbons outside the defined gasoline range are present in the sample; NWTPH-Dx recommended.
- S - Surrogate recovery data is not available due to the necessary dilution of the sample.
- T - The sample chromatogram is not similar to a typical _____.
- U - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.
- V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.
- X - Sample underwent silica gel cleanup procedures.
- Y - Sample underwent acid cleanup procedures.
- Z - Interferences were present which prevented the quantitation of the analyte below the detection limit reported.
- ND - Not Detected
MRL - Method Reporting Limit
PQL - Practical Quantitation

Chain of Custody

Company: Herrera Environmental
 Project No.: C491.30
 Project Name: GSA/Fed Center South
 Project Manager: Peter Jounie

Turn Around Requested
 (Check One)
☐ Same Day
☐ 24 Hours
☒ 48 Hours
☒ Standard
☐ (other)

Project Chemist: DAB
 Laboratory No. 08-050

						Requested Analysis													
Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	# of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Dx	Volatiles by 8240/624/8260	Halogenated Volatiles by 8260	Semivolatiles by 8270/625	PAHs by 8270/625	PCBs by 8081/608	Total RCRA Metals (8)	TCLP Metals	VPH	EPH	metals (total) Zn, Cr	% Moisture
1	GP1-5	8/11/98	930	soil	1		X												X
2	GP7-5		1130		1		X	X											X
3	GP8-5		1145		1		X	X											X
4	GP10-5		1535		1		X												X
5	GP12-7		1650		2			X	X			X	X					X	X
6	GP13-5		1715		1			X											X
7	GP14-5		1755		1			X	X			X	X					X	X
8	GP3-W1		945	water	2		X												X
9	GP4-W1		1020		2		X												
10	GP9-W1		1420		2		X												
11	GP10-W1		1600		2		X												
12	GP11-W1		1640		2		X												

RELINQUISHED BY <u>Bruce A. Gupta</u>	DATE <u>8/12/98</u>	RECEIVED BY <u>R. J. Weller</u>	DATE <u>8-12-98</u>	COMMENTS: Added 8/19/98 for C/BTEX (soil) DB Added 8/21/98 for DB DB
FIRM <u>Herrera Environmental</u>	TIME <u>17:40</u>	FIRM <u>DOLE</u>	TIME <u>5:00 PM</u>	
RELINQUISHED BY	DATE	RECEIVED BY	DATE	
FIRM	TIME	FIRM	TIME	
REVIEWED BY		DATE REVIEWED		

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**OnSite
Environmental Inc.**

Analytical Testing and Mobile Laboratory Services

August 26, 1998

AUG 27 1998

Peter Jowise
Herrera Environmental Consultants, Inc.
2200 6th Avenue, Suite 601
Seattle, WA 98121

Re: Analytical Data for Project C491.30
Laboratory Reference No. 9808-059

Dear Peter:

Enclosed are the analytical results and associated quality control data for samples submitted on August 12, 1998.

The standard policy of OnSite Environmental Inc., is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Chemist

Enclosures

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-G/BTEX

Date Extracted: 8-22-98
Date Analyzed: 8-22-98

Matrix: Water
Units: ug/L (ppb)

Client ID: **GP4-W1**
Lab ID: 08-059-09

GP9-W1
08-059-10

	Result	Flags	PQL	Result	Flags	PQL
Benzene	13		1.0	3.7		1.0
Toluene	ND		1.0	ND		1.0
Ethyl Benzene	ND		1.0	ND		1.0
m,p-Xylene	1.2		1.0	ND		1.0
o-Xylene	ND		1.0	ND		1.0
TPH-Gas	130		100	ND		100
Surrogate Recovery:						
Fluorobenzene	91%			86%		

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-G/BTEX

Date Extracted: 8-22-98
Date Analyzed: 8-22-98

Matrix: Water
Units: ug/L (ppb)

Client ID: **GP10-W1**
Lab ID: 08-059-11

GP11-W1
08-059-12

	Result	Flags	PQL	Result	Flags	PQL
Benzene	ND		1.0	2.5		1.0
Toluene	ND		1.0	ND		1.0
Ethyl Benzene	ND		1.0	ND		1.0
m,p-Xylene	ND		1.0	ND		1.0
o-Xylene	ND		1.0	ND		1.0
TPH-Gas	ND		100	ND		100
Surrogate Recovery:						
Fluorobenzene	88%			85%		

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
METHOD BLANK QUALITY CONTROL**

Date Extracted: 8-22-98
Date Analyzed: 8-22-98

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0822W1

	Result	Flags	PQL
Benzene	ND		1.0
Toluene	ND		1.0
Ethyl Benzene	ND		1.0
m,p-Xylene	ND		1.0
o-Xylene	ND		1.0
TPH-Gas	ND		100

Surrogate Recovery:
Fluorobenzene

88%

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
DUPLICATE QUALITY CONTROL**

Date Extracted: 8-22-98
Date Analyzed: 8-22-98

Matrix: Water
Units: ug/L (ppb)

Lab ID:	08-059-11 Original	08-059-11 Duplicate	RPD	Flags
Benzene	ND	ND	NA	
Toluene	ND	ND	NA	
Ethyl Benzene	ND	ND	NA	
m,p-Xylene	ND	ND	NA	
o-Xylene	ND	ND	NA	
TPH-Gas	ND	ND	NA	
Surrogate Recovery:				
Fluorobenzene	88%	87%		

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-G/BTEX
MS/MSD QUALITY CONTROL**

Date Extracted: 8-22-98
Date Analyzed: 8-22-98

Matrix: Water
Units: ug/L (ppb)
Spike Level: 50.0 ppb

Lab ID:	08-059-11 MS	Percent Recovery	08-059-11 MSD	Percent Recovery	RPD
Benzene	48.7	98	49.1	98	0.70
Toluene	50.2	100	50.5	101	0.58
Ethyl Benzene	51.0	102	51.6	103	1.2
m,p-Xylene	50.5	101	51.0	102	1.0
o-Xylene	50.9	102	51.5	103	1.1

Surrogate Recovery:

Fluorobenzene	87%	90%
---------------	-----	-----

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx

Date Extracted: 8-20&21-98
Date Analyzed: 8-20&21-98

Matrix: Soil
Units: mg/Kg (ppm)

Client ID:	GP7-5	GP8-5
Lab ID:	08-059-02	08-059-03

Diesel Fuel:	68	400
PQL:	29	32

Heavy Oil:	170	ND
PQL:	57	64

Surrogate Recovery:		
o-Terphenyl	84%	71%

Flags:

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

NWTPH-Dx
METHOD BLANK QUALITY CONTROL

Date Extracted: 8-20-98
Date Analyzed: 8-20-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: MB0820S1

Diesel Fuel: ND
PQL: 25

Heavy Oil: ND
PQL: 50

Surrogate Recovery:
o-Terphenyl 65%

Flags:

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-Dx
DUPLICATE QUALITY CONTROL**

Date Extracted: 8-19-98
Date Analyzed: 8-20-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 08-099-04 08-099-04 DUP

Diesel Fuel: ND ND
PQL: 25 25

RPD: N/A

Surrogate Recovery:
o-Terphenyl 73% 62%

Flags:

Date of Report: August 26, 1998
Samples Submitted: August 12, 1998
Lab Traveler: 08-059
Project: C491.30

**NWTPH-Dx
SB/SBD QUALITY CONTROL**

Date Analyzed: 08-19-98

Matrix: Soil
Units: mg/Kg (ppm)

Spike Level: 100 ppm

Lab ID:	SB0819S1	SB0819S1 DUP
---------	----------	--------------

Diesel Fuel:	87.4	86.2
--------------	------	------

PQL:	25	25
------	----	----

Percent Recovery:	87	86
-------------------	----	----

RPD:	1.4	
------	-----	--

Surrogate Recovery:		
o-Terphenyl	89%	90%

Flags:



**OnSite
Environmental Inc.**

DATA QUALIFIERS AND ABBREVIATIONS

- A - Due to high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.
 - B - The analyte indicated was also found in the blank sample.
 - C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.
 - D - Data from 1:____ dilution.
 - E - The value reported exceeds the quantitation range, and is an estimate.
 - F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.
 - G - Insufficient sample quantity for duplicate analysis.
 - J - The value reported was below the practical quantitation limit. The value is an estimate.
 - K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.
 - M - Predominantly _____ range hydrocarbons present in the sample.
 - N - Hydrocarbons in the gasoline range (C7-toluene) are present in the sample which are elevating the diesel result.
 - O - Hydrocarbons in the heavy oil range (>C24) are present in the sample which are elevating the diesel result.
 - P - Hydrocarbons in the diesel range (C12-C24) are present in the sample which are elevating the oil result.
 - Q - The RPD of the results between the two columns is greater than 25.
 - R - Hydrocarbons outside the defined gasoline range are present in the sample; NWTPH-Dx recommended.
 - S - Surrogate recovery data is not available due to the necessary dilution of the sample.
 - T - The sample chromatogram is not similar to a typical _____.
 - U - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.
 - V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.
 - X - Sample underwent silica gel cleanup procedures.
 - Y - Sample underwent acid cleanup procedures.
 - Z - Interferences were present which prevented the quantitation of the analyte below the detection limit reported.
- ND - Not Detected
MRL - Method Reporting Limit
PQL - Practical Quantitation



OnSite Environmental Inc.

14924 NE 31st Circle • Redmond, WA 98052
Fax: (425) 885-4603 • Phone: (425) 883-3881

Chain of Custody

Page 1 of 2

Company: Herrera Environmental

Project No.: C491.30

Project Name: GSA/Fed Center South

Project Manager: Peter Jowise

Turn Around Requested: (Check One)

☐ Same Day

☐ 24 Hours

☒ 48 Hours

☒ Standard

☐ (other) _____

Project Chemist: DAB

Laboratory No. 08-059

Requested Analysis

NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Dx	Volatiles by 8240/624/8260	Halogenated Volatiles by 8260	Semivolatiles by 8270/625	PAHs by 8270/625	PCB's by 8081/508	Total RCRA Metals (8)	TCLP Metals	VPH	EPH	metals (total) Zn, Cr	% Moisture
------------	---------------	----------	----------------------------	-------------------------------	---------------------------	------------------	-------------------	-----------------------	-------------	-----	-----	-----------------------	------------

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	# of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Dx	Volatiles by 8240/624/8260	Halogenated Volatiles by 8260	Semivolatiles by 8270/625	PAHs by 8270/625	PCB's by 8081/508	Total RCRA Metals (8)	TCLP Metals	VPH	EPH	metals (total) Zn, Cr	% Moisture
1	GP1-5	8/11/98	830	Soil	1		X												X
2	GP7-5		1130		1		X	X											X
3	GP8-5		1145		1		X	X											X
4	GP10-5		1535		1		X												X
5	GP12-7		1650		2			X	X			X	X					X	X
6	GP13-5		1715		1			X											X
7	GP14-5		1755		1			X	X			X	X					X	X
8	GP3-W1		945	water	2		X												X
9	GP4-W1		1020		2														
10	GP9-W1		1420		2														
11	GP10-W1		1600		2														
12	GP11-W1		1640		2														

RELINQUISHED BY: <u>Brian A. Gupta</u>	DATE: <u>8/12/98</u>	RECEIVED BY: <u>R. Jowise</u>	DATE: <u>8-12-98</u>	COMMENTS: @ Added 8/19/98 per G/BTEX result. DB ● Added 8/21/98 per DB. DB
FIRM: <u>Herrera Environmental</u>	TIME: <u>17:40</u>	FIRM: <u>OSL</u>	TIME: <u>5:00 PM 17:40</u>	
RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:	
FIRM:	TIME:	FIRM:	TIME:	
REVIEWED BY:	DATE REVIEWED:			



Company:	Herrera Environmental
Project No.:	C491.30
Project Name:	GSA / Fed Center South
Project Manager:	Peter Louise

Page 2 of 2[illegible]

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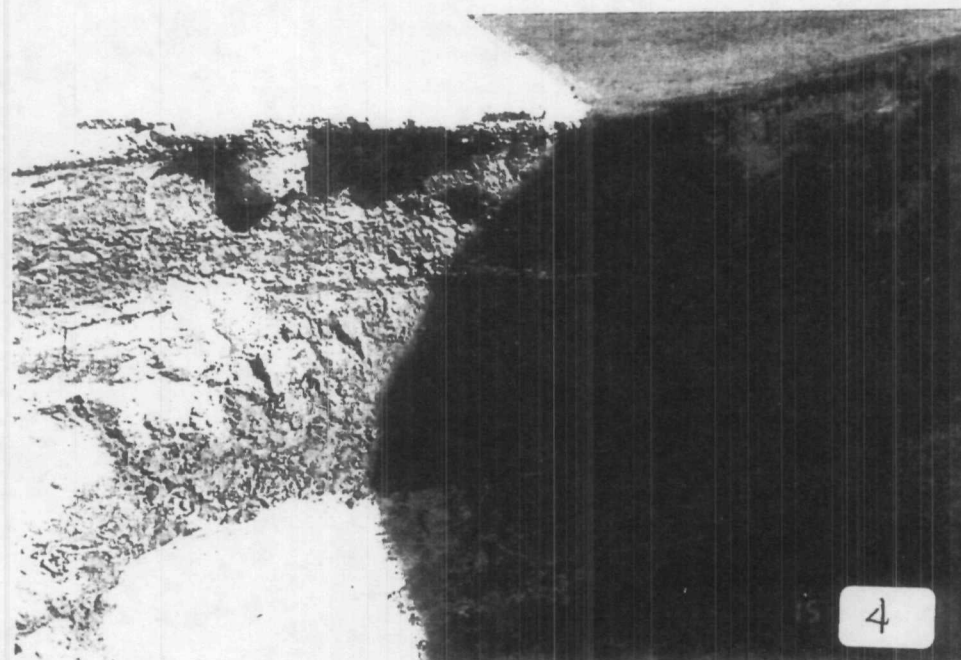
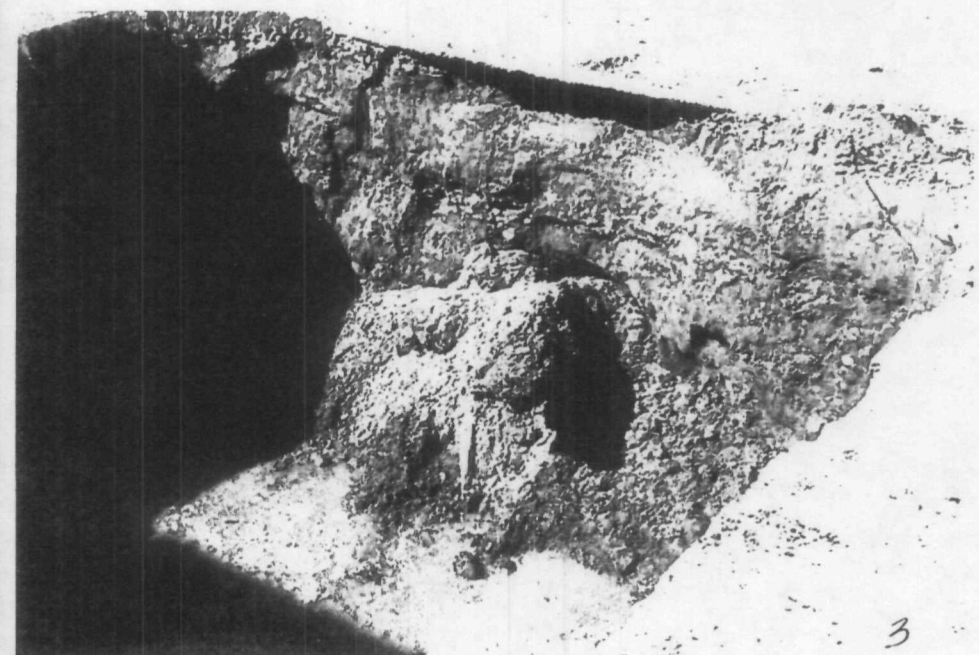
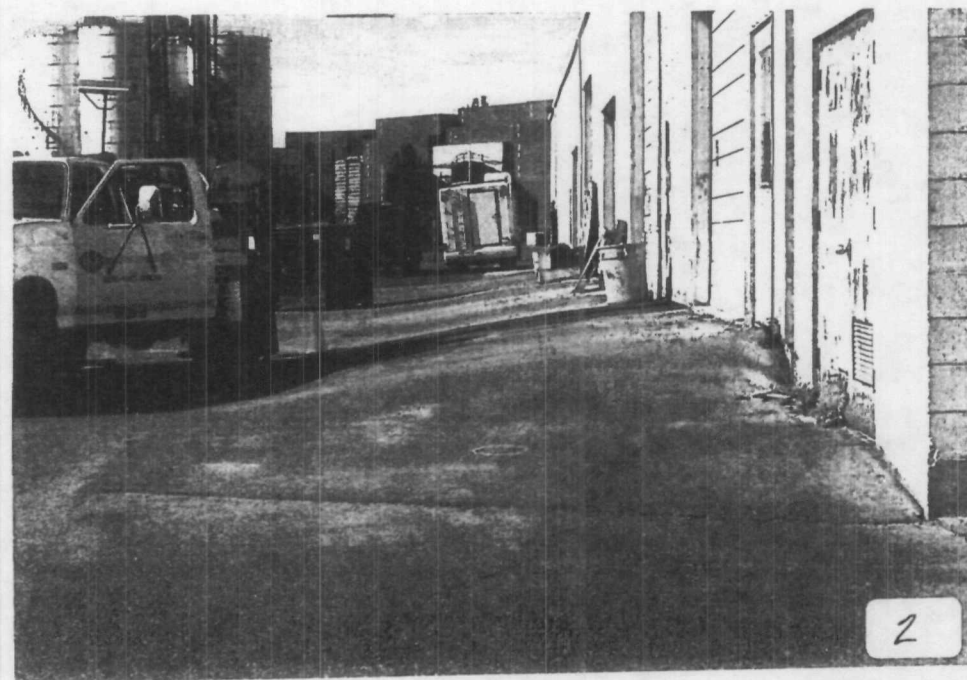
APPENDIX D

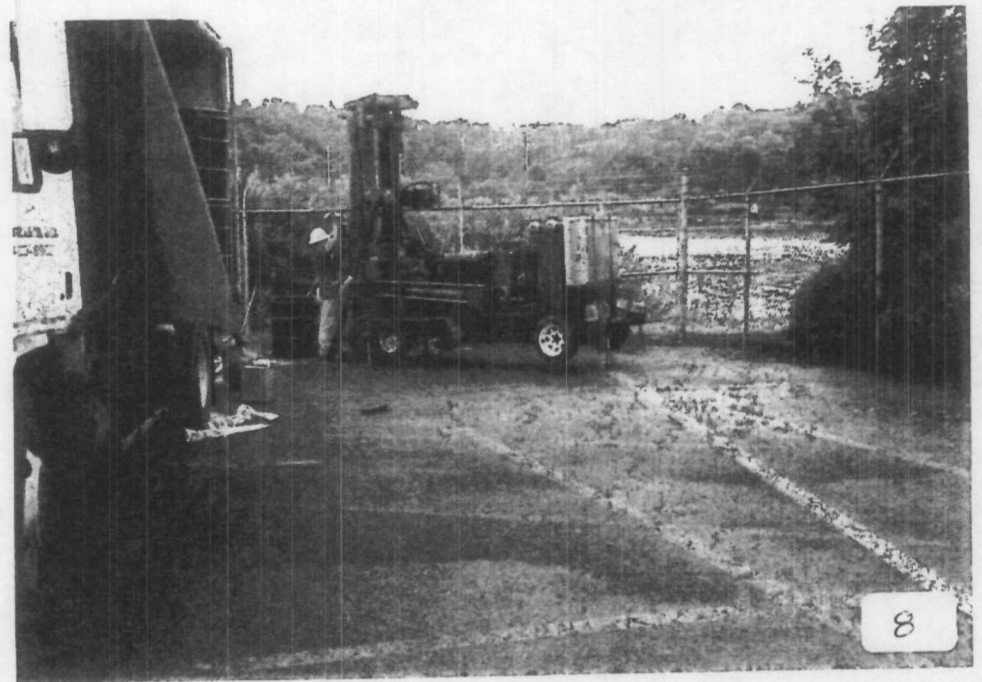
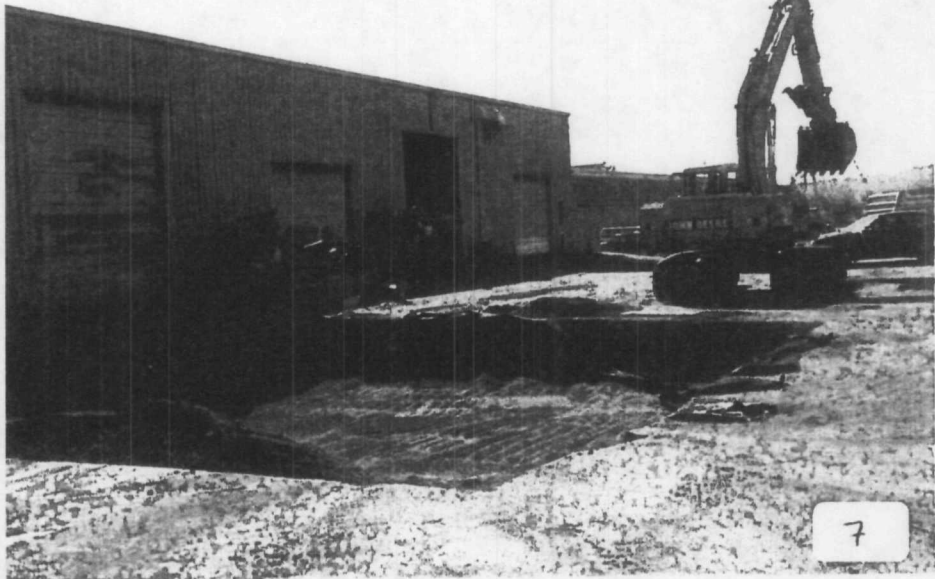
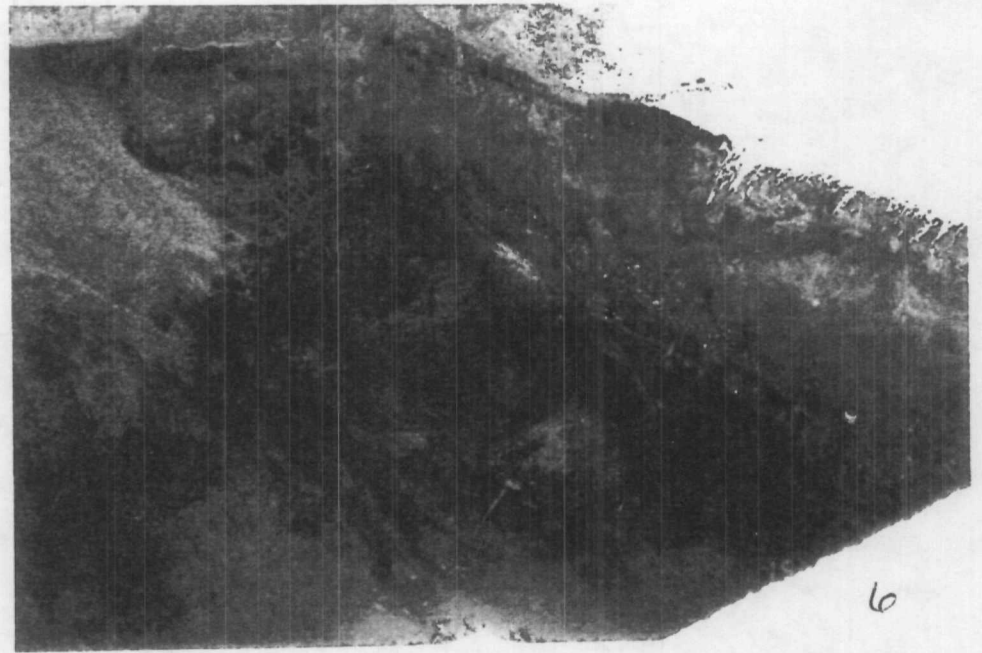
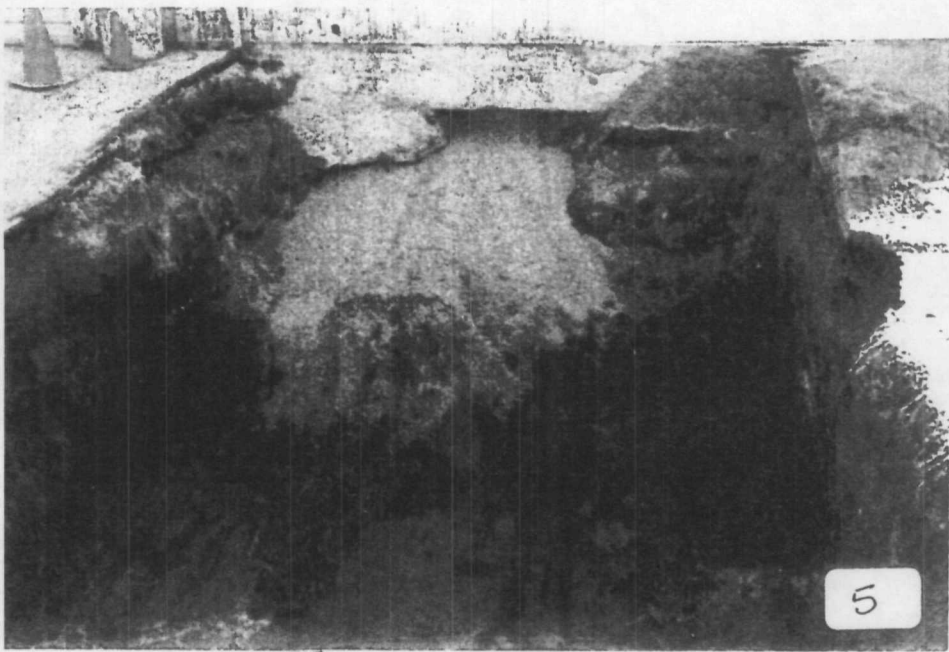
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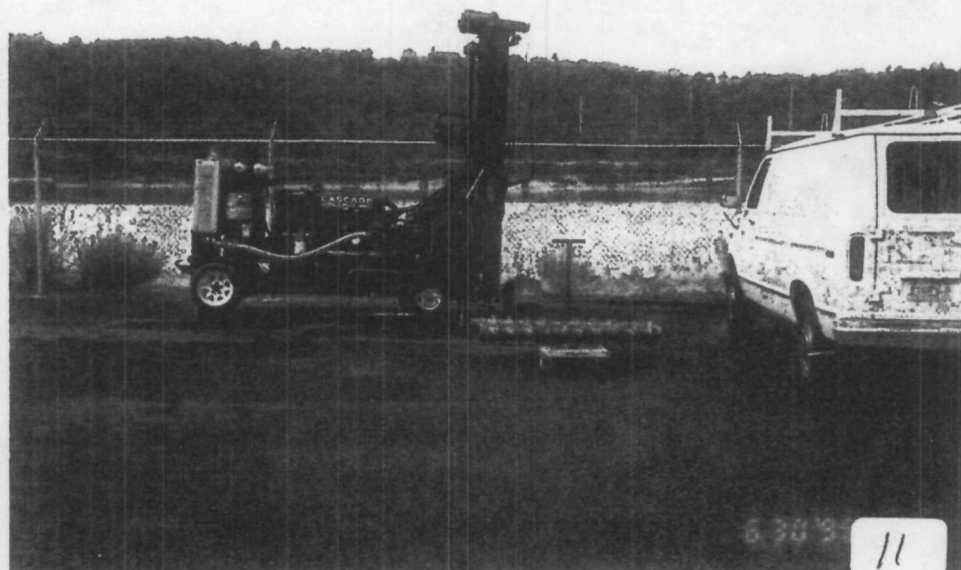
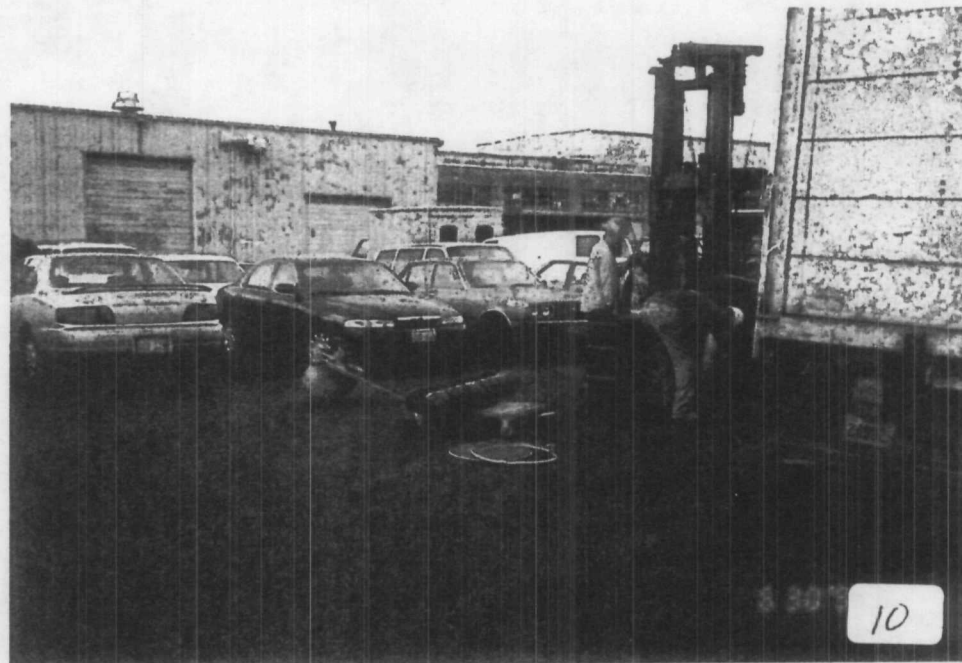
**Photographic Documentation
Environmental Site Assessment
Federal Center South
Seattle, Washington**

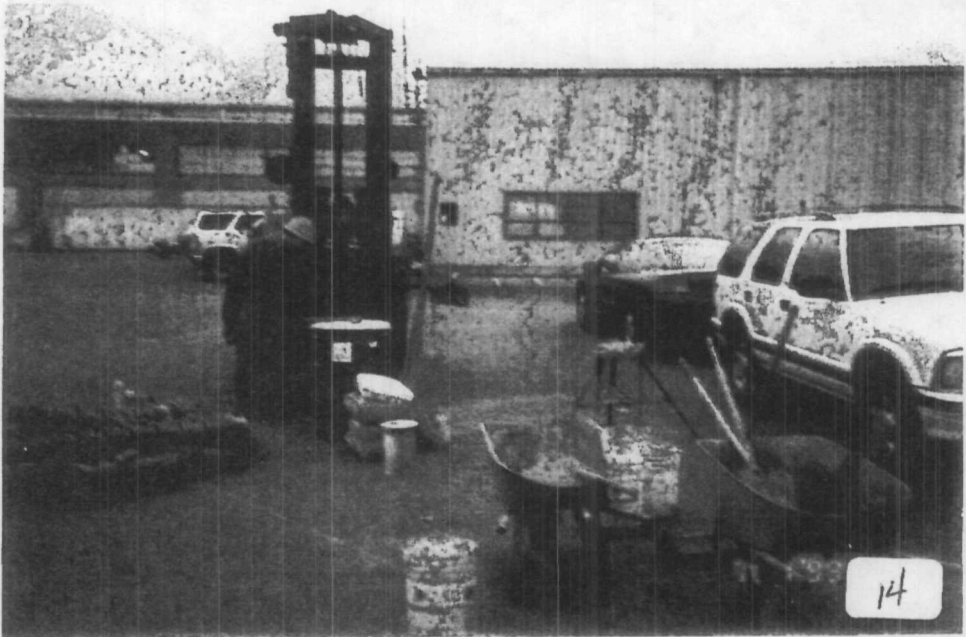
Photo Number	Photo Description
1	View of probe drill rig positioned on probe boring location GP-6, with traffic cone in foreground marking location of probe boring GP-5, looking to the south. Building on the left side of the photo is Building 12.03.
2	View of probe drill rig positioned on probe boring location GP-7, looking to the south. Building on the right side of the photo is Building 12.03.
3	View of the south sidewall of the additional excavation in the vicinity of the former dispenser area, looking to the southeast.
4	View of the north sidewall of the additional excavation in the vicinity of the former dispenser area, looking to the northeast.
5	View of the additional pit excavation and east sidewall of the former waste oil tank, looking to the east.
6	View of the southeast corner and south sidewall of the additional excavation for the waste oil tank, looking to the southeast.
7	Backfilling the pit excavation of the former dispenser area, looking to the southeast.
8	View of monitoring well location FC-1, looking to the west.
9	View of monitoring well location FC-2, looking to the east.
10	View of monitoring well location FC-3, looking to the southeast.
11	View of monitoring well location FC-4 along the fence and western property boundary, looking to the west. Surface body of water in background is the Duwamish Waterway.
12	View of monitoring well location FC-5, looking to the east-northeast. Dark asphalt patched area on the asphalt paving next to the building shown on the left side of the photo is the location of the former waste oil tank.
13	View of monitoring well location FC-6, looking to the southeast.
14	View of monitoring well location FC-7 and the north end of Building 12.03, looking to the east.

Refer to Figures 3 through 7 for boring and well locations.









APPENDIX E

Weigh Tickets—Remedco Inc.

--- AL CALIF. 17FEB71 2102



ALASKA STREET CUSTOMER SUMMARY SHEET

Customer Revised
489648

PEOPLE'S

[illegible]

416.09 TONS

SPCOM

SPCOM

Number 1990 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

Hauled by
 Marilyn's

ID NO. 1

TICKET 1990

M I WEIGHIN 101740 LB

GROSS 101740 LB
 TARE 36360 LB
 NET 65380 LB
 32.69 TONS

TIME 12:29 PM 14 APR 99

From Remedco
 To Profile #489648
 Address _____

Bill M-1

SD-800

Number 1993 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

Hauled by ID NO. 1

TICKET 1993

Marilyn's
 Trucking
 M I

GROSS
 NTARE
 NET

101220 LB
 36360 LB
 64860 LB
 32.43 TONS

TIME 01:09 PM 14 APR 99

From Remedco
 To Profile #489648
 Address _____

Bill M-1

SD-800

SPCOM

Number 2005 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

Hauled by
 Marilyn's

ID NO. 1

TICKET 2005

M I

GROSS
 NTARE
 NET

112640 LB
 36360 LB
 76280 LB
 38.14 TONS

TIME 04:16 PM 14 APR 99

From Remedco
 To Profile #489648
 Address Federal center

Bill M-1

Number 1975 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1975

WEIGHT 48280 LB

GROSS 48280
 TARE 22680
 NET 25600
 12.80 TONS

TIME 09:56 AM 14 APR 99

From Remedco
 To Profile #489648

Address _____

SSD-800

Number 1980 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1980

GROSS 53100
 TARE 22680
 NET 30420
 15.21 TONS

TIME 10:32 AM 14 APR 99

From Remedco
 To Profile #489648

Address _____

SSD-800

Number 1978 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1978

GROSS 52180
 TARE 22680
 NET 29500
 14.75 TONS

TIME 10:12 AM 14 APR 99

From Remedco
 To Profile #489648

Address _____

SSD-800

Number 1981 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1981

GROSS 49200
 TARE 22680
 NET 26520
 13.26 TONS

TIME 10:47 AM 14 APR 99

From Remedco
 To Profile #489648

Address _____

SSD-800

Number 1982 Date _____
 Commodity _____ @ _____ per _____
 Weighed by TZON

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0

TICKET 1982

GROSS
 NTARE
 NET

51880
 22680
 29200
 14.60 TONS

TIME 11:01 AM 14 APR 99

From Remedco
 To Profile # 489648
 Address _____

SSD-800

Number 1984 Date _____
 Commodity _____ @ _____ per _____
 Weighed by TZON

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0

TICKET 1984

GROSS
 NTARE
 NET

57920
 22680
 35240
 17.62 TONS

TIME 11:44 AM 14 APR 99

From Remedco
 To Profile # 489648
 Address _____

SSD-800

Number 1983 Date _____
 Commodity _____ @ _____ per _____
 Weighed by TZON

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0

TICKET 1983

GROSS
 NTARE
 NET

55860
 22680
 33180
 16.59 TONS

TIME 11:16 AM 14 APR 99

From Remedco
 To Profile # 489648
 Address _____

SSD-800

Number 1987 Date _____
 Commodity _____ @ _____ per _____
 Weighed by TZON

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0

TICKET 1987

GROSS
 NTARE
 NET

53200
 22680
 30520
 15.26 TONS

TIME 12:01 PM 14 APR 99

From Remedco
 To Profile # 489648
 Address _____

SSD-800

Number 1989 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

WMT ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1989

GROSS 53160
 NTARE 22680
 NET 30480
 15.24 TONS

TIME 12:21 PM 14 APR 99

From Remedco
 To Prof. Co #489648
 Address _____

800-800

Number 1992 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

WMT ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1992

GROSS 56040
 NTARE 22680
 NET 33360
 16.68 TONS

TIME 12:50 PM 14 APR 99

From Remedco
 To Prof. Co #489648
 Address _____

800-800

Number 1994 Date _____
 Commodity _____ @ _____ per _____
 Weighed by _____

WMT ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1994

GROSS 54500
 NTARE 22680
 NET 31820
 15.91 TONS

TIME 01:17 PM 14 APR 99

From Remedco
 To Prof. Co #489648
 Address _____

800-800

Number 1996 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

WMT ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 1996

GROSS 50600
 NTARE 22680
 NET 27920
 13.96 TONS

TIME 01:40 PM 14 APR 99

From Remedco
 To Prof. Co #489648
 Address _____

800-800

Number 1997 Date 4-14-99
 Commodity WMI ARRF @ 70 S ALASKA ST per SEATTLE WA
 Weighed by Don

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0

TICKET 199

GROSS
 NTARE
 NET

54680
 22680
 31980
 15.99 TONS

TIME 01:57 PM 14 APR 99

From REMEDCO
 To PROFILE # 489648
 Address _____

SSD-800

Number 2000 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0

TICKET 2000

GROSS
 NTARE
 NET

53280
 22680
 30600
 15.30 TONS

TIME 02:55 PM 14 APR 99

From Remedco
 To Profile #489648
 Address _____

D-800

Number 1993 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0

TICKET 199

GROSS
 NTARE
 NET

51400
 22680
 28720
 14.36 TONS

TIME 02:13 PM 14 APR 99

From Remedco
 To Profile #489648
 Address _____

SSD-800

Number 2002 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

WMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 00

TICKET 2000

WEIGHTIN 61540 LB

GROSS
 TARE
 NET

41500
 22900
 38600
 19.32 TONS

TIME 02:49 PM 14 APR 99

From Remedco
 To Profile #489648
 Address _____

SSD-800

Number 2014 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 701

GROSS 57000
 TARE 22680
 NET 34320
 17.16 TONS

TIME 10:38 AM 15 APR 99

From Remedco
 To Profile # 489648
 Address _____

SSD-800

Number 2007 Date 4-15-99
 Commodity _____ @ _____ per _____
 Weighed by MHE

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 6 TICKET 700

WEIGHTIN 63240 LB

GROSS 63240
 TARE 22860
 NET 40380
 20.19 TONS

TIME 08:35 AM 15 APR 99

From REMEDCO
 To PROFILE # 489648
 Address _____

SSD-800

Number 2014 Date _____
 Commodity _____ @ _____ per _____
 Weighed by Don

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 701

GROSS 57000
 TARE 22680
 NET 34320
 16.45

TIME 10:06 AM 15 APR 99

From Remedco
 To Profile # 489648
 Address _____

SSD-800

Number 2006 Date 4-14-99
 Commodity _____ @ _____ per _____
 Weighed by MHE

UMI ARRF
 70 S ALASKA ST
 SEATTLE WA

ID NO. 0 TICKET 700

GROSS 47040
 TARE 22680
 NET 24360
 12.18 TONS

TIME 04:21 PM 14 APR 99

From REMEDCO
 To PROFILE # 489648
 Address _____

SSD-800

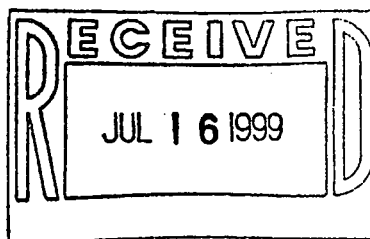
APPENDIX F

Ground Water Monitoring Program Laboratory Analytical Certificates— OnSite Environmental Inc.



**OnSite
Environmental Inc.**

Analytical Testing and Mobile Laboratory Services



July 13, 1999

Bruce Carpenter
Herrera Environmental Consultants, Inc.
2200 6th Avenue, Suite 601
Seattle, WA 98121

Re: Analytical Data for Project 491.30
Laboratory Reference No. 9907-027

Dear Bruce:

Enclosed are the analytical results and associated quality control data for samples submitted on July 7, 1999.

The standard policy of OnSite Environmental Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

NWTPH-G/BTEX

Date Extracted: 7-8-99
Date Analyzed: 7-8&9-99

Matrix: Water
Units: ug/L (ppb)

Client ID: FC1-1
Lab ID: 07-027-01

FC2-1
07-027-02

	Result	Flags	PQL	Result	Flags	PQL
Benzene	ND		1.0	5.1		1.0
Toluene	ND		1.0	12		1.0
Ethyl Benzene	ND		1.0	91		1.0
m,p-Xylene	ND		1.0	160		5.0
o-Xylene	ND		1.0	15		1.0
TPH-Gas	ND		100	820		100
Surrogate Recovery:						
Fluorobenzene	91%			86%		

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

NWTPH-G/BTEX

Date Extracted: 7-8-99
Date Analyzed: 7-8&9-99

Matrix: Water
Units: ug/L (ppb)

Client ID: **FC3-1**
Lab ID: 07-027-03

FC4-1
07-027-04

	Result	Flags	PQL	Result	Flags	PQL
Benzene	3.5		1.0	ND		1.0
Toluene	ND		1.0	ND		1.0
Ethyl Benzene	ND		1.0	ND		1.0
m,p-Xylene	ND		1.0	ND		1.0
o-Xylene	ND		1.0	ND		1.0
TPH-Gas	ND		100	ND		100
Surrogate Recovery:						
Fluorobenzene	84%			82%		

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

NWTPH-G/BTEX

Date Extracted: 7-8-99
Date Analyzed: 7-8-99

Matrix: Water
Units: ug/L (ppb)

Client ID: **FC5-1**
Lab ID: 07-027-05

FC7-1
07-027-06

	Result	Flags	PQL	Result	Flags	PQL
Benzene	ND		1.0	ND		1.0
Toluene	ND		1.0	ND		1.0
Ethyl Benzene	ND		1.0	ND		1.0
m,p-Xylene	ND		1.0	ND		1.0
o-Xylene	ND		1.0	ND		1.0
TPH-Gas	ND		100	ND		100
Surrogate Recovery:						
Fluorobenzene	88%			88%		

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

NWTPH-G/BTEX

Date Extracted: 7-8-99
Date Analyzed: 7-8-99

Matrix: Water
Units: ug/L (ppb)

Client ID: **FC6-1**
Lab ID: 07-027-07

	Result	Flags	PQL
Benzene	ND		1.0
Toluene	ND		1.0
Ethyl Benzene	19		1.0
m,p-Xylene	9.4		1.0
o-Xylene	ND		1.0
TPH-Gas	500	T	100
Surrogate Recovery: Fluorobenzene	83%		

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

**NWTPH-G/BTEX
METHOD BLANK QUALITY CONTROL**

Date Extracted: 7-8-99
Date Analyzed: 7-8-99

Matrix: Water
Units: ug/L (ppb)

Lab ID: MB0708W2

	Result	Flags	PQL
Benzene	ND		1.0
Toluene	ND		1.0
Ethyl Benzene	ND		1.0
m,p-Xylene	ND		1.0
o-Xylene	ND		1.0
TPH-Gas	ND		100
Surrogate Recovery:			
Fluorobenzene	86%		

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

**NWTPH-G/BTEX
DUPLICATE QUALITY CONTROL**

Date Extracted: 7-8-99
Date Analyzed: 7-9-99

Matrix: Water
Units: ug/L (ppb)

Lab ID:	07-027-03 Original	07-027-03 Duplicate	RPD	Flags
Benzene	3.51	3.78	7.4	
Toluene	ND	ND	NA	
Ethyl Benzene	ND	ND	NA	
m,p-Xylene	ND	ND	NA	
o-Xylene	ND	ND	NA	
TPH-Gas	ND	ND	NA	
Surrogate Recovery:				
Fluorobenzene	84%	87%		

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

**NWTPH-G/BTEX
MS/MSD QUALITY CONTROL**

Date Extracted: 7-8-99
Date Analyzed: 7-8-99

Matrix: Water
Units: ug/L (ppb)
Spike Level: 50.0 ppb

Lab ID:	07-018-02 MS	Percent Recovery	07-018-02 MSD	Percent Recovery	RPD
Benzene	48.9	93	48.4	92	1.0
Toluene	45.7	91	45.3	91	0.84
Ethyl Benzene	55.3	91	55.0	90	0.75
m,p-Xylene	62.7	91	62.3	90	0.89
o-Xylene	46.1	92	46.0	92	0.24

Surrogate Recovery:

Fluorobenzene	90%	89%
---------------	-----	-----

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

NWTPH-Dx

Date Extracted: 7-8-99
Date Analyzed: 7-13-99

Matrix: Water
Units: mg/L (ppm)

Client ID:	FC3-1	FC4-1	FC5-1
Lab ID:	07-027-03	07-027-04	07-027-05

Diesel Fuel:	ND	ND	ND
PQL:	0.25	0.25	0.25

Heavy Oil:	ND	0.52	ND
PQL:	0.50	0.50	0.50

Surrogate Recovery:			
o-Terphenyl	67%	51%	75%

Flags:

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

NWTPH-Dx
METHOD BLANK QUALITY CONTROL

Date Extracted: 7-8-99
Date Analyzed: 7-9-99

Matrix: Water
Units: mg/L (ppm)

Lab ID: MB0708W1

Diesel Fuel: ND
PQL: 0.25

Heavy Oil: ND
PQL: 0.50

Surrogate Recovery:
o-Terphenyl 78%

Flags:

Date of Report: July 13, 1999
Samples Submitted: July 7, 1999
Lab Traveler: 07-027
Project: 491.30

NWTPH-Dx
DUPLICATE QUALITY CONTROL

Date Extracted: 7-8-99
Date Analyzed: 7-13-99

Matrix: Water
Units: mg/L (ppm)

Lab ID: 07-027-05 07-027-05 DUP

Diesel Fuel: ND ND
PQL: 0.25 0.25

RPD: N/A

Surrogate Recovery:
o-Terphenyl 75% 59%

Flags:



DATA QUALIFIERS AND ABBREVIATIONS

- A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.
- B - The analyte indicated was also found in the blank sample.
- C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.
- D - Data from 1:____ dilution.
- E - The value reported exceeds the quantitation range, and is an estimate.
- F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.
- G - Insufficient sample quantity for duplicate analysis.
- H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.
- I - Compound recovery is outside of the control limits.
- J - The value reported was below the practical quantitation limit. The value is an estimate.
- K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.
- L - The RPD is outside of the control limits.
- M - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.
- O - Hydrocarbons outside the defined gasoline range are present in the sample; NWTPH-Dx recommended.
- P - The RPD of the detected concentrations between the two columns is greater than 40.
- Q - Surrogate recovery is outside of the control limits.
- S - Surrogate recovery data is not available due to the necessary dilution of the sample.
- T - The sample chromatogram is not similar to a typical gasoline.
- U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.
- W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.
- X - Sample extract treated with a silica gel cleanup procedure.
- Y - Sample extract treated with an acid cleanup procedure.
- Z -
- ND - Not Detected
- MRL - Method Reporting Limit
- PQL - Practical Quantitation Limit
- RPD - Relative Percent Difference



Chain of Custody

Company:	Herrera Environmental
Project No.:	491.30
Project Name:	Fed Center South
Project Manager:	Bruce Carpenter

Turn Around Requested			Project Chemist: DB		Laboratory No. 07-027	
(Check One) <input type="checkbox"/> Same Day <input type="checkbox"/> 24 Hours <input type="checkbox"/> 48 Hours <input checked="" type="checkbox"/> Standard <input type="checkbox"/> (other)			Requested Analysis			
Time Sampled	Matrix	# of Cont.	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Dx	% Moisture
1030	Water	2		X		
1130		2		X		
1315		4		X	X	
1248		4		X	X	
1420		4		X	X	
1458		2		X		
1550		2		X		
D BY: Cheryl Anderson			DATE: 7/7/99		COMMENTS: Sent Via Courier	
D BY: Site			TIME: 11:00 AM			
D BY:			DATE:			
VIEWED			TIME:			

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